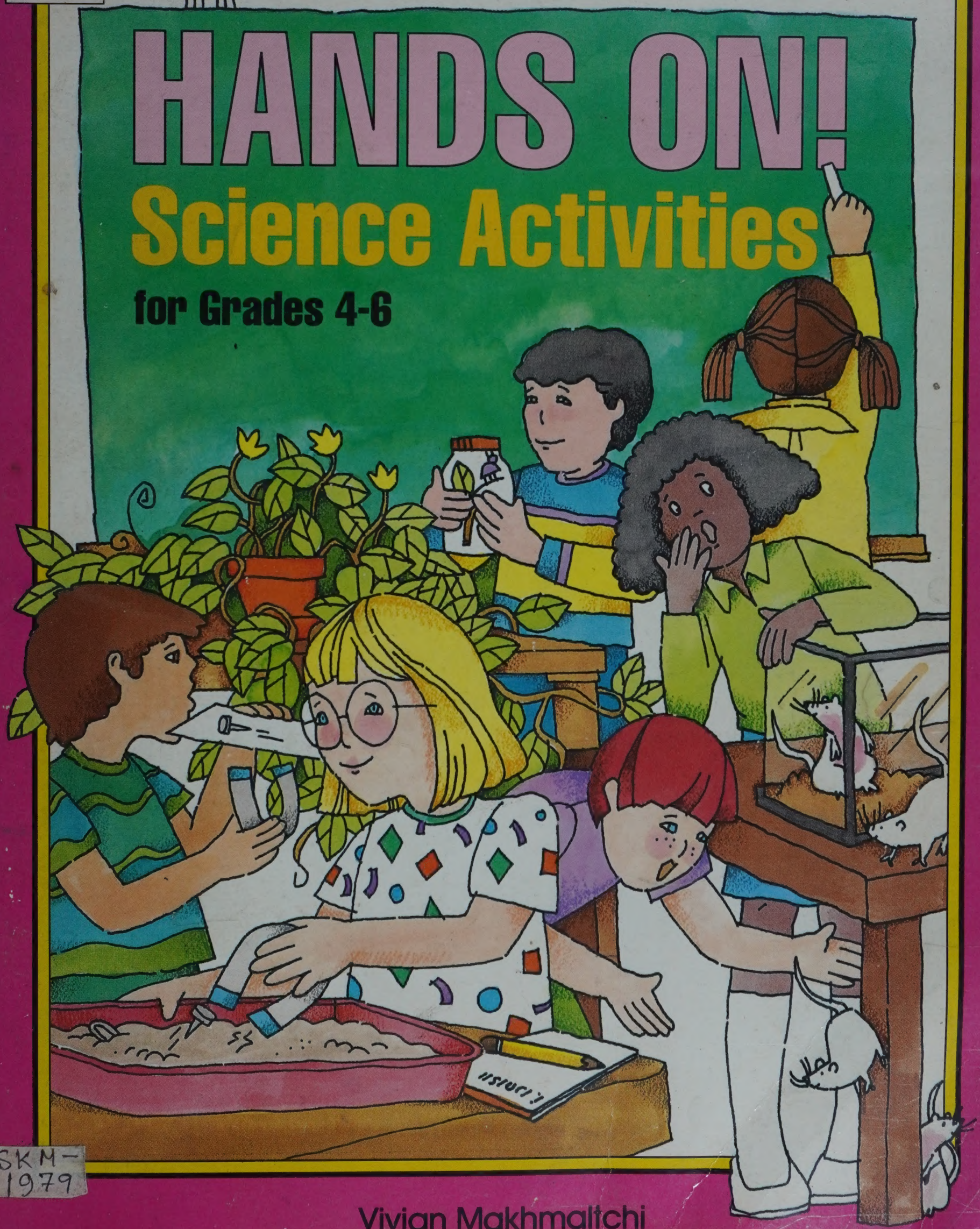
TROLL TEACHER IDEAS

HANDS ON!

Science Activities

for Grades 4-6



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Vivian Makhmaltchi

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Science Activities

for Grades 4-6

Vivian Makhmaltchi

Troll Associates

Interior Illustrations by: Shirley Beckes

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ISBN: 0-8167-2592-6

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

Contents

Introduction v
See a Cell 7
The Pizza Kingdom 8
Finding Your Roots—and Stems and Leaves 9
Plant Food Factory 10
Food for Thought 11
A Pride of Dande-Lions 12
Stalking the Xylem Tubes 13
It's a Gas—O_2 14
Detecting Sugar and Starch 15
How Does Your Garden Grow? 16
Nature Recycles—and So Should You! . . 17
The CO_2 Effect 18
Skeletons—Inside or Outside? 19
Soaking Up 20
Helpful Worms? 21
Seafood Delight 22
A Success in the Animal Kingdom 23
Build a Bug 24
Boning Up 25
Go Fish! 26
"I Led Two Lives" by Ima Frog 27
Descendants of Dinosaurs 28
This Is for the Birds! 29
Chill Out, Warm In 30
Animal Camouflage 31
It's a Small World 32–33
The Water Goes Round and Round 34
Living in a Fishbowl 35
Which Biome Is Home? 36
Biome, Sweet Biome 37
From the Sun 38–39
What's the Matter? 40
Let's Go on an "Element" Hunt 41
Atoms Are Partic-ular! 42
Compounding the Matter 43
How Sweet It Was! 44
Do You Know the Solution—Or Are You in Suspense? 45
Making Vibrations 46
Now You Hear It, Now You Don't 47
What's the Pitch? 48
The Notion of Motion 49
It Just Keeps Rollin' Along 50
Something's Got to Give 51
The Forces Be with You—Friction and Gravity 52
Identifying the Work Force 53
It's an Attractive Wrap! 54
Making Light of It 55
Be a Better Meter Reader 56
Going Around in Powerful Circles 57
Catch a Sunbeam! 58
That's the Way the Ball Bounces 59
A Rock Record 60
Earthquakes—Whose Fault? 61
It's Cast or Molded in Stone 62
Once upon a Time 63

How Salty Is the Ocean? 64
Making Waves 65
Current Events 66
Salt of the Earth 67
Record Temperatures 68
When You Are Hot, Is Everyone Hot? . . . 69
Do You Know Weather . . . ? 70
"Who Has Seen the Wind?" 71
It's All in Vane 72
It's All Relative 73
Making a Barometer—Under Pressure! . . 74
Weather or Not 75
Do Point out the Dew Point—
I'm in a Fog 76
All's Quiet on the Western Front 77
As Different as Night and Day 78
Going Around in the Best Circles 79
A Shadow of Myself 80
Shadows of Time 81
Using Your Head to Show an Eclipse 82
A Model System 83
Seeing Stars 84
News from Near and Far 85
Some Bones About It 86
Muscling In 87
"You've Gotta Have Heart"—and Lungs . 88
An Ounce of Prevention 89
You Have a Lot of Nerves—and Glands . 90
Drugs: Use or Abuse? 91
Do You Have Blue Genes? 92
Make a Mild Child Monster 93
Bibliography 94

Introduction

Hands On! Science Activities for Grades 4–6 is designed to help you explore and enrich your science curriculum. Since students in grades 4–6 are frequently able to record pertinent information in notebooks or on lined paper, suggestions for ways to record are often made in the activities. Student activity sheets frequently explore related material and leave room for more complex recording, such as completing a chart or a figure.

Today's science curriculum is becoming increasingly student-centered and hands-on. Except when safety or lack of materials is a concern, encourage student-centered group work. Most materials are readily available from ordinary classroom resources or from science supply houses such as the Carolina Biological Supply Company at (800) 334-5551. You may wish to skim the materials list for each activity in advance so that you can order and have the needed materials ready. At the same time you may want to note adaptations or extensions to activities that will work well with your students.

The main objective of these activities is for students to enjoy and appreciate science. It is the author's opinion that a little humor in the titles and diagrams is a useful tool in promoting student interest and understanding. The activities were fun to write and we hope will be fun to do. It's time for "hands-on, minds-on" science!

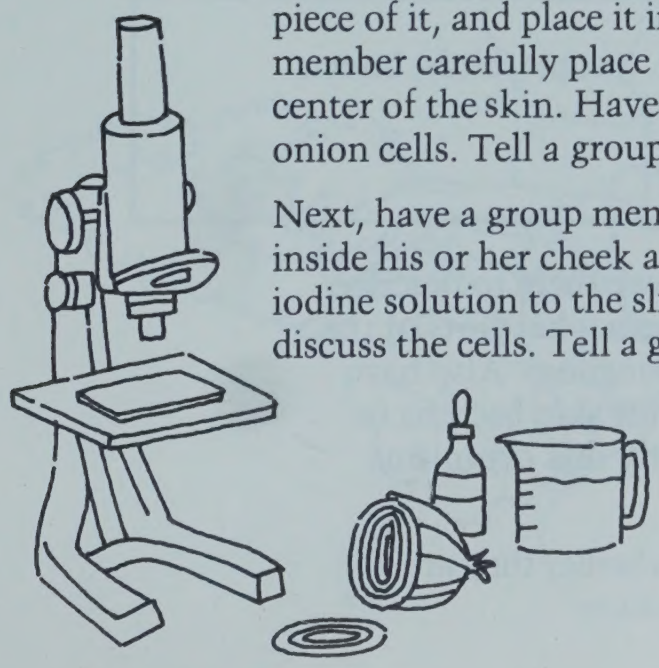
See a Cell

Concept: The cell is the basic unit of all living things. Organisms such as plants and animals have different cells.

Materials: *For each group:* microscope, microscope slides, onion, water, iodine solution with dropper, flat toothpick, copy of the chart below.

Plan: Tell students that they will see plant and animal cells, draw diagrams of them, and compare the cells. Draw a simple chart like the one below on the chalkboard and have a group member in each group copy it.

Onion cell	Cheek cell
Similarities	**Differences**



Have a group member peel a thin piece of onion skin, tear off a small piece of it, and place it in a drop of water on the slide. Have another member carefully place one or two drops of iodine solution in the center of the skin. Have all group members observe and describe the onion cells. Tell a group member to draw one cell on the chart.

Next, have a group member use the toothpick to rub off cells from inside his or her cheek and place them on a slide. Add a drop of iodine solution to the slide and have all group members observe and discuss the cells. Tell a group member to draw one cell on the chart.

The Pizza Kingdom

Concept: Living things can be classified. The five-kingdom system classifies living things as monerans, protists, fungi, plants, and animals.

Materials: *For each student:* a slice of pizza containing sausage, peppers and mushrooms.

Plan: Copy the chart on the chalkboard. You may want to read and discuss the descriptions with students rather than copying them all.

Kingdom	Description	Example
monerans	simple, single cell; some make own food, some don't	some bacteria
protists	complex, single cell; some make own food, some don't	organisms in pond water
fungi	many-celled; absorb food from living or dead things	mushrooms, yeast
plants	many-celled; make their own food	daisy, maple tree
animals	many-celled; do not make their own food	people, birds, insects

Have students examine the slice of pizza and ask them to describe which kingdoms are represented on it. Ask them what parts of the pizza might have been members of the plant kingdom. Also have students consider whether it is possible for some skin bacteria to have gotten on the pizza and whether it is likely that organisms found in pond water are present also.

Have students identify living things and tell whether they are animals, plants, or fungi.

Finding Your Roots—and Stems and Leaves

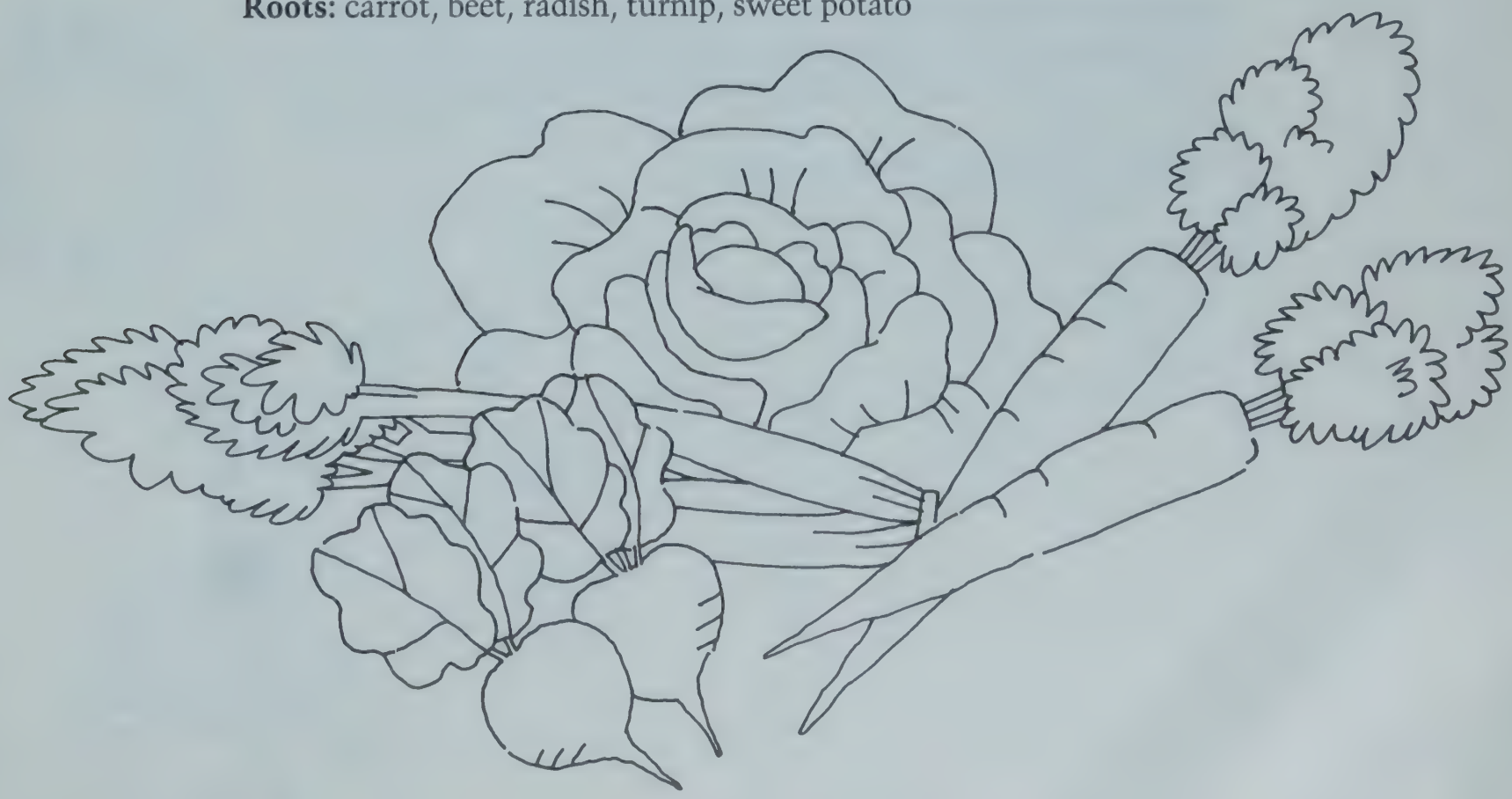
Concept: There are over 200,000 species of seed-producing plants. These plants have roots, stems, and leaves.

Materials: A variety of small plants including African violet, dandelion, beet, carrot, radish, and white potato. All should have roots, stems, and leaves attached.

Plan: Distribute a plant to each group of students. Explain that although there are differences among the plants, each has roots, stems, and leaves. Have each group identify the roots, stems, and leaves of their plant. Ask one group member to draw the plant; ask another to label the parts. Have groups share and compare their information and drawings. The group whose plant is the white potato may have trouble with their identification since the edible part of the potato is actually a food-storing underground stem called a tuber and not a root.

Additional Activity: Have students make a chart entitled Edible Parts. Have them list plants whose leaves are edible, whose stems are edible, and whose roots are edible.

Possible answers include the following:
Leaves: lettuce, cabbage, dandelion, mint, basil
Stems: celery, rhubarb, white potato
Roots: carrot, beet, radish, turnip, sweet potato



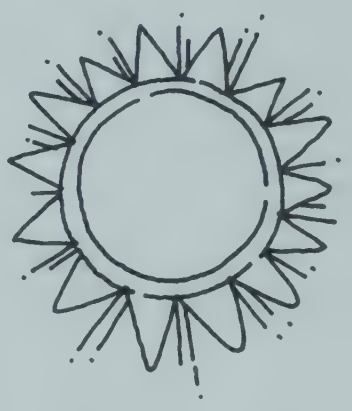
Plant Food Factory

Concept: Plants produce their own food through the process called photosynthesis. Plants need light, carbon dioxide (a gas found in air), and water in order to carry out photosynthesis. Chlorophyll (green matter in the leaves and stem of a plant) traps the light the plant needs.

Materials: *For each group:* four houseplants such as impatiens, stick-on labels marked A, B, C, D, water, self-seal plastic bag.

Plan: Tell students that plants need food to survive and that in order to make their food they need light, air, and water. Explain to students that they will experiment to see what happens to a plant that is deprived of either light, air, or water. Assign one member of each group to the control plant, labeled A, which should be properly watered and exposed to sunlight and air. Tell another member to place plant B in a dark closet. Remind this student to water plant B regularly. Tell a third student to place plant C in sunlight but to be sure *not* to water it. Assign a fourth student to place plant D in a self-seal plastic bag, squeezing out as much air as possible before sealing. Tell this student to water plant D regularly but to see to it that the plant is exposed to as little air as possible while watering. After two days, four days, one week, and two weeks, have students report on the progress of their plants. Ask students to compare the health of the plants and summarize their findings about what plants need to survive.

Additional Activity: Have students research and list human survival needs. Since humans do not produce their own food, students should include food on their lists. Ask students whether human beings can survive longest without air, water, food, or light and to give a reason for their answers.

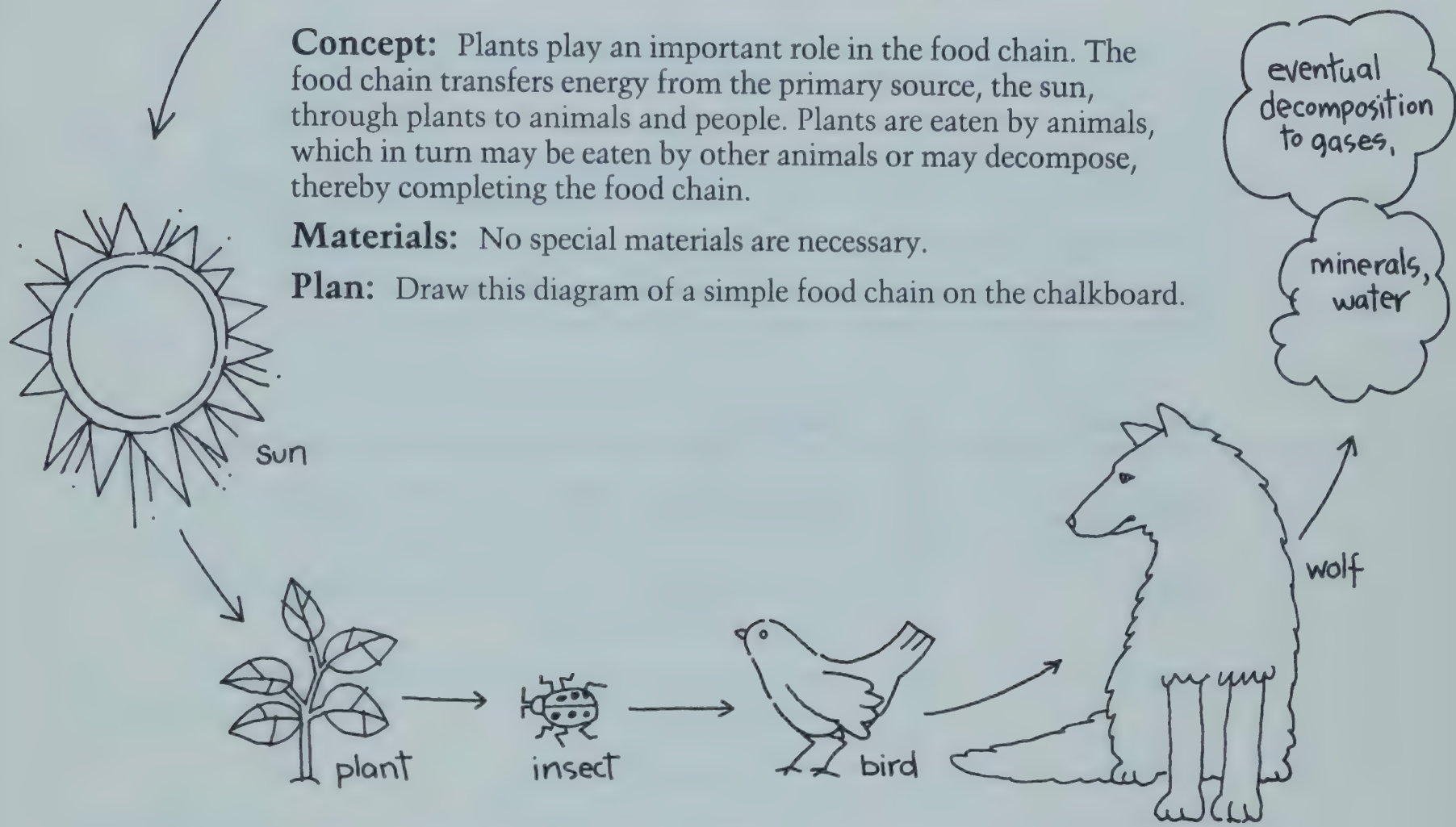


Food for Thought

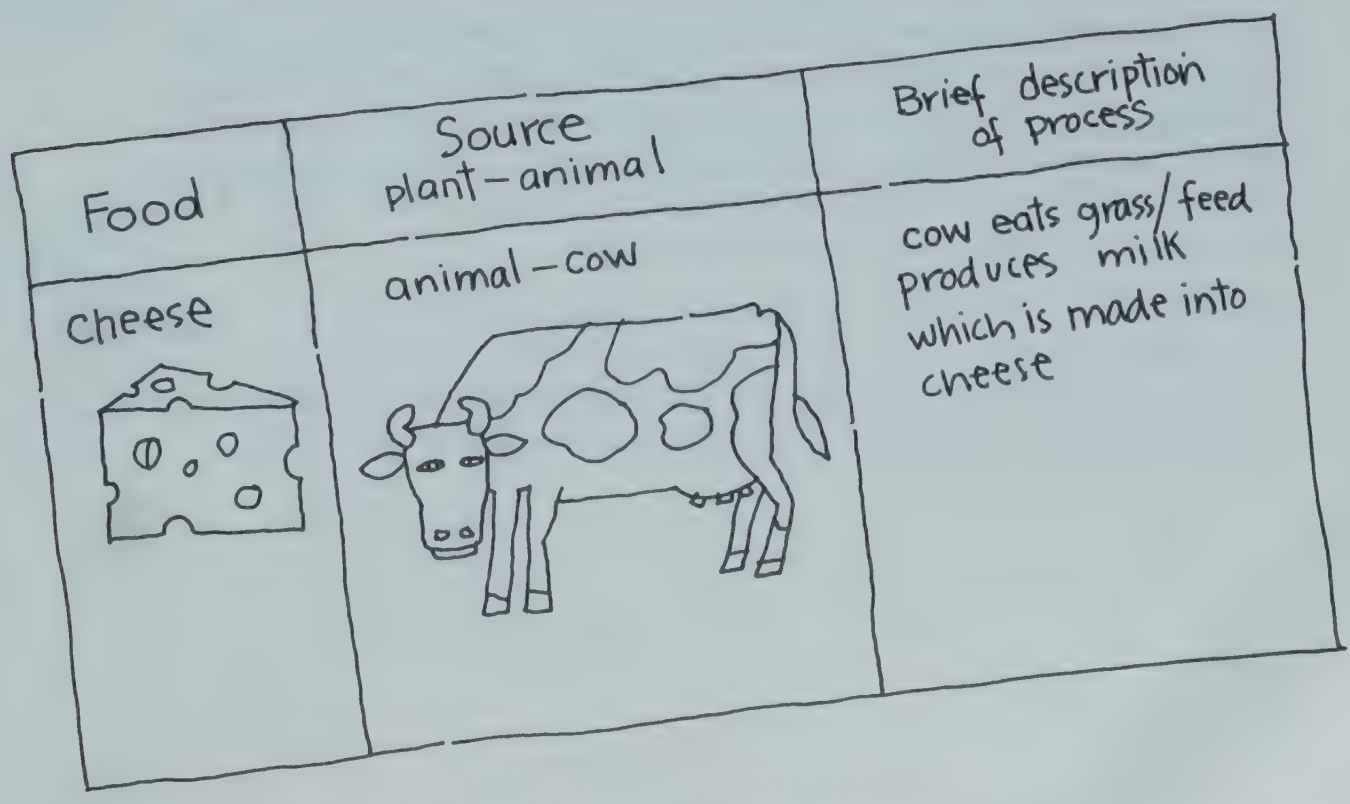
Concept: Plants play an important role in the food chain. The food chain transfers energy from the primary source, the sun, through plants to animals and people. Plants are eaten by animals, which in turn may be eaten by other animals or may decompose, thereby completing the food chain.

Materials: No special materials are necessary.

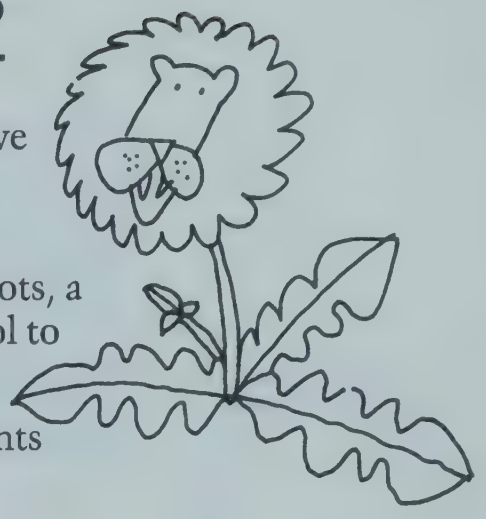
Plan: Draw this diagram of a simple food chain on the chalkboard.



Then, in their notebooks or separate sheets of paper, ask students to list foods they eat and to tell whether these foods come directly from plants or whether animals were involved in the food's production. If animals were involved, have students indicate the animal.



A Pride of Dande-Lions



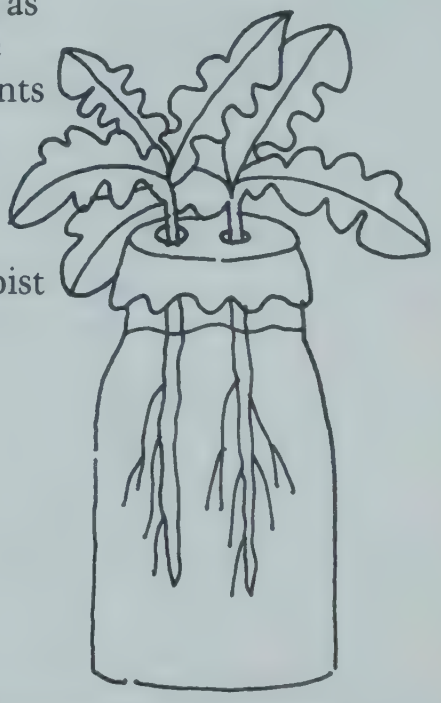
Concept: The roots, stems, leaves, and flowers of a plant have special functions. The function of roots is to absorb water and minerals.

Materials: *For each group:* several dandelion plants with roots, a small-necked glass or clear plastic jar, water, pencil or other tool to punch holes, aluminum foil or plastic wrap.

Plan: Copy the chart on the chalkboard and explain to students that they are going to observe one of the functions of a root.

PLANT PART	FUNCTIONS
Roots	• absorb water and minerals from soil; anchor plants in soil
Stems	• transport minerals and water to leaves; transport food from leaves; support plant
Leaves	• manufacture food using sunlight, minerals, and water through photosynthesis
Flowers	• enable plants to reproduce

Explain to students that they will be doing an experiment that shows one of the functions of plant roots. First have students fill the small-necked jar with water almost to the top. Then have them place several dandelion plants in the jar so that the roots are in the water and the stem and leaves are in the air. Have students puncture holes in aluminum foil or plastic wrap and put the exposed parts of the plants through them. Then tell students to secure the wrap or foil as tightly as possible to the jar opening to prevent evaporation. Have students observe the water level in the jar over several days. Students should see that dandelion roots absorb water.



Additional Activity: Have students use common root vegetables such as carrots, sweet potatoes, radishes, and beets to make a root garden. Have students plant the vegetable roots in moist soil and observe the growth of roots, root hairs, leaves, and stems.

Stalking the Xylem Tubes

Concept: Water and minerals move from the roots of a plant through xylem (wooden tissue) tubes in the stem to the leaves.

Materials: *For each student:* celery stalk with leaves, knife, red or blue food coloring, water, cup.

Plan: Tell students that water and minerals move through xylem tubes from a plant's roots to its leaves where food making, or photosynthesis, takes place.

Have students stir several drops of food coloring into 1/2 cup (125 ml) water. Next have students carefully cut the bottom part of a celery stalk and place the stalk in the cup of colored water. Let the celery stand in the water overnight. The next day, have students cut across the stalk and record their observations. Ask students if other parts of the plant have changed color and to speculate on why they might have.

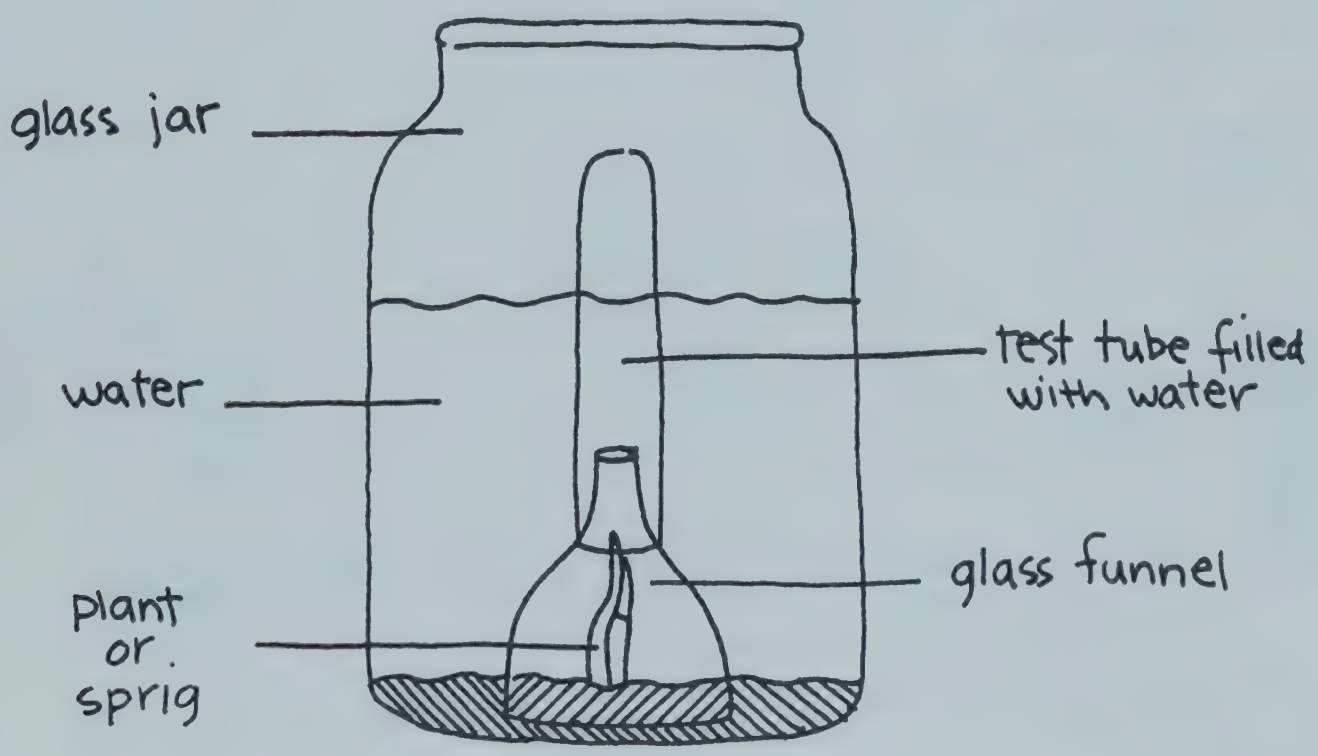
Additional Activity: Have students make a diagram, write a paragraph, or compose a poem that describes the travels of a drop of water from a watering can through the soil, plant roots, and xylem tubes to the food-making cells in the leaf of a plant.

It's a Gas–O_2

Concept: In the process of photosynthesis, plants give off oxygen.

Materials: *For each pair:* a water plant such as the hornwort or anacharis (sprigs of elodea will work, too), large glass jar, glass funnel, test tube, water.

Plan: Explain to students that as plants produce their food during the process of photosynthesis, they give off oxygen. Have students work in pairs. Tell them to place the plant in the jar and then cover the plant with water. Then have students place the funnel over the plant (wide end down). The next (and most difficult) step is carefully to fill the test tube with water and place it over the narrow end of the funnel, losing as little water as possible.



The jar and its contents should be placed in sunlight to promote photosynthesis. After two days, have students observe what has happened to the water level in the test tube. Help them to conclude that the O_2 given off in photosynthesis has caused the water level in the test tube to drop.

Additional Activity: Some students might repeat the experiment using two jars and putting one in the dark to see if the amount of sunlight affects the process of photosynthesis and therefore the amount of O_2 given off.

Detecting Sugar and Starch

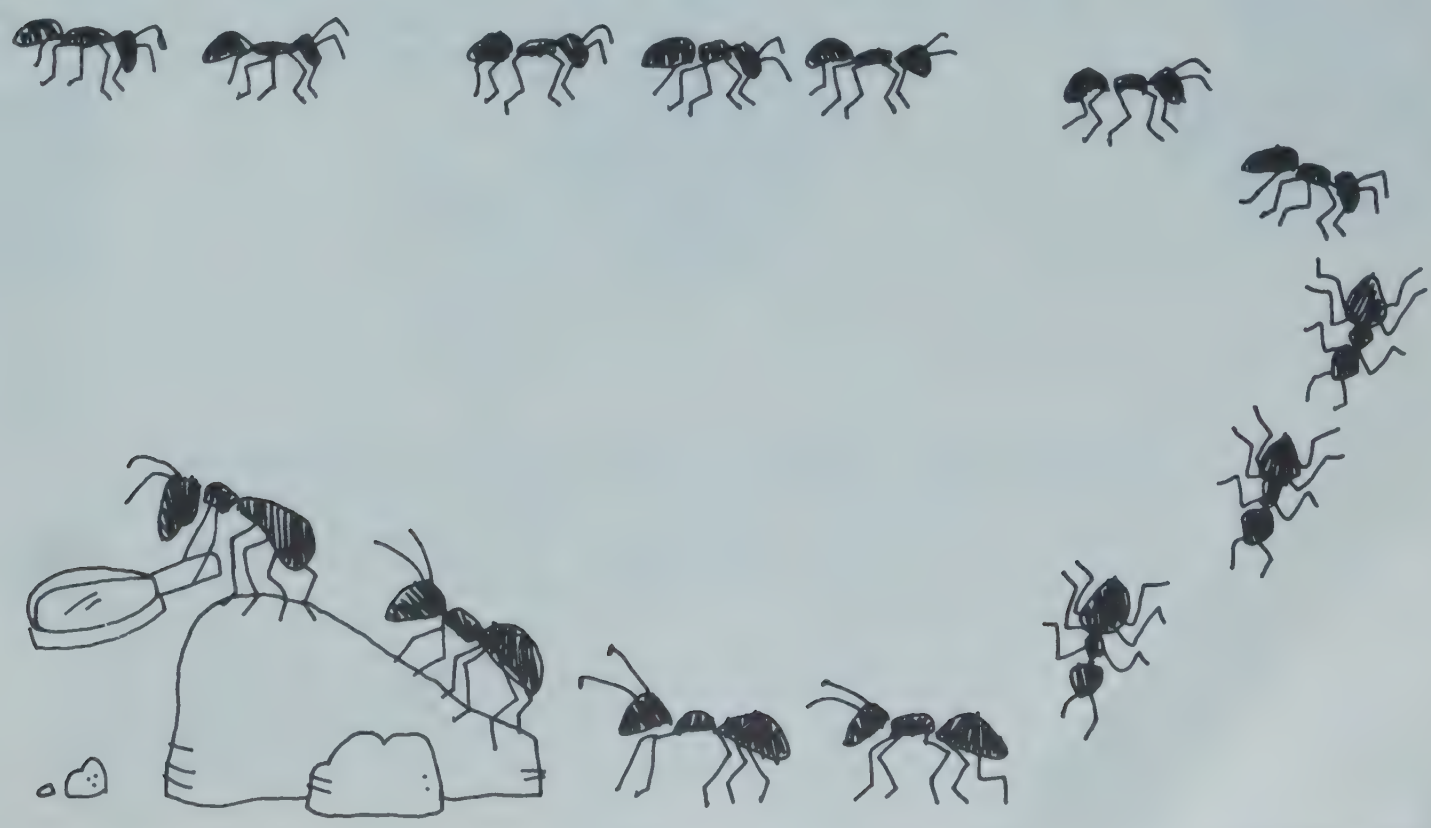
Concept: Many plants produce more food (sugar) than they can use immediately. They store their excess food as sugar and starch.

Materials: *For each group:* several different food plants or fruits and vegetables, knife, iodine solution, water, sugar indicator strips (from biological supply house or drug store), kitchen cornstarch, refined sugar.

Plan: Tell students that sugar or starch is stored in many plants and that they can detect the presence of these substances by using iodine and sugar indicators. Have students cut parts of the plants, fruits, or vegetables. (Caution them regarding the use of knives.) To test for starch, have students put a drop of iodine solution on the parts they cut. If a part turns dark blue or black, starch is present. To test for sugar, have students place a drop of water on the plant part, wait a few minutes, and then place the sugar indicator strips on the wet part of the plant. The instructions on the strip package will tell students how to determine if sugar is present.

For a dramatic display of the presence of starch and sugar, have students test cornstarch and refined sugar.

Have student groups record their findings by listing the plant name, whether sugar or starch was present, and which part of the plant (root, stem, leaf, or flower) is edible.



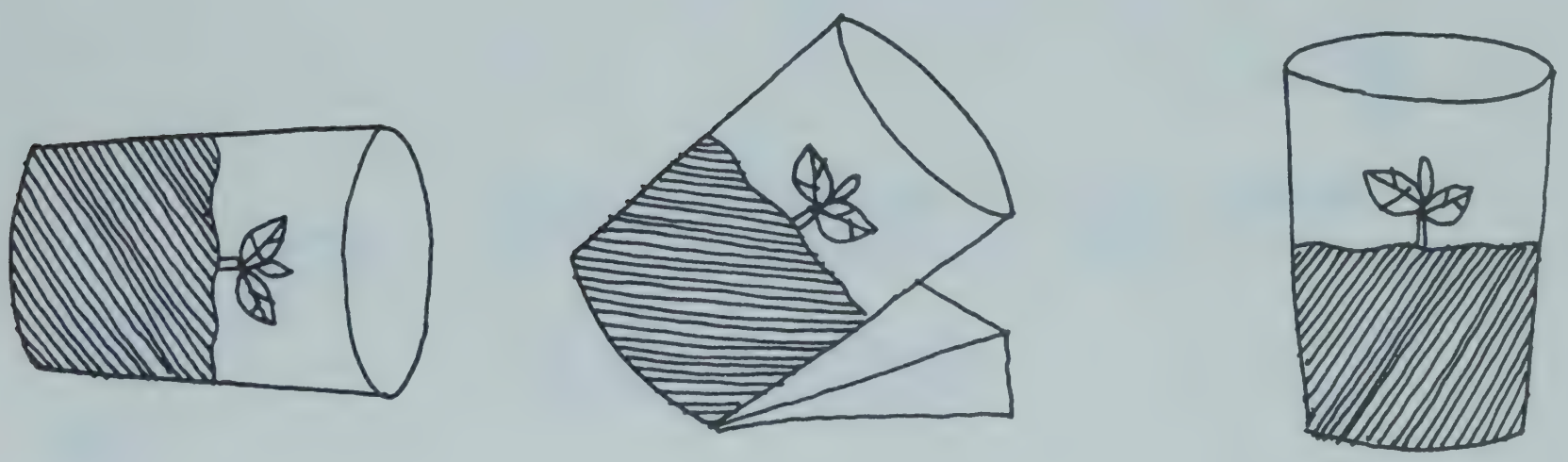
How Does Your Garden Grow?

Concept: Plants respond to outside factors. Responses of plants that involve growth movement are called *tropisms.*

Materials: *For each group:* several small plants such as radish or lima bean seedlings, two or three clear plastic cups, water, paper towels.

Plan: Tell students that different parts of plants may respond to outside stimuli in different ways. Have students place a few damp paper towels in each cup, then place the seedlings in the cups, and finally place the cups on a sunny windowsill. Next have students observe the growth of the seedlings every two days for two weeks. Have groups discuss their observations and report their conclusions to the class. Most groups will notice that the leaves and the stems of the seedlings grow toward the sun (a growth response called *phototropism*) while the roots grow away from the sun (a growth response called *negative phototropism*).

Additional Activity: Have students take three seedlings, place each in a clear plastic cup containing soil, and then position the cups as shown.



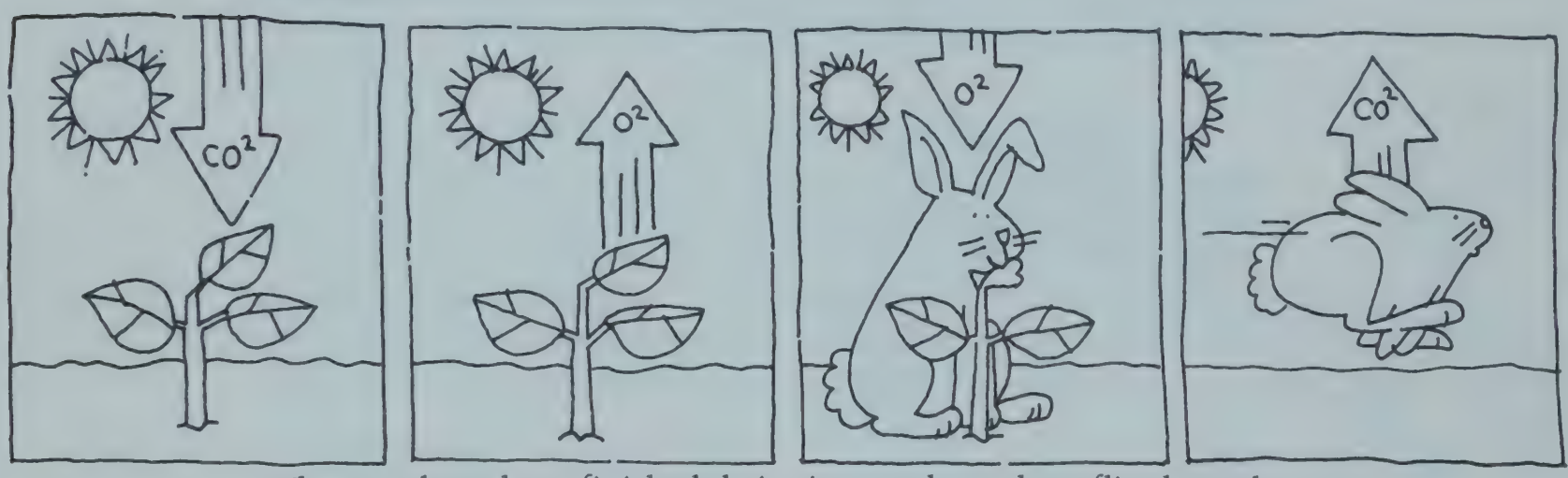
Students should water (by spraying) and observe the plants for several days. Students' results should indicate that roots grow down (exhibit *positive geotropism,* a growth response to gravity) while stems grow up (exhibit *negative geotropism*).

Nature Recycles–and So Should You!

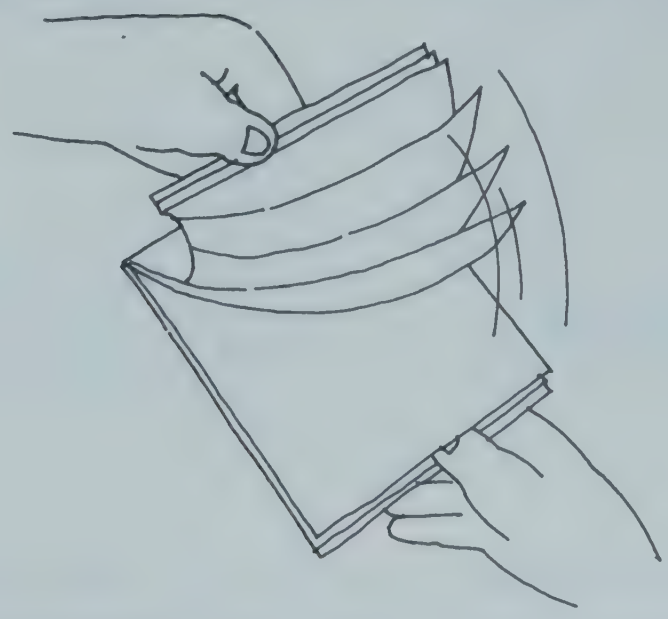
Concept: The sun, plants, and animals are all partners in the O_2-CO_2 cycle.

Materials: *For each student:* small pad of paper, pens, crayons or pencils.

Plan: Discuss the fact that the life processes of plants and animals make the O_2-CO_2 cycle possible. Green plants take in CO_2 from the atmosphere and use it in the presence of sunlight to manufacture food. In the food-manufacturing process, oxygen is given off. Animals consume food and breathe in oxygen. As they burn their food, animals release CO_2. Distribute materials and tell students that they will draw pictures which, when flipped, will show this cycle in action.



When students have finished their pictures, have them flip through the pages to review the process. Some students may find that drawing a single picture several times will make a better flip book.



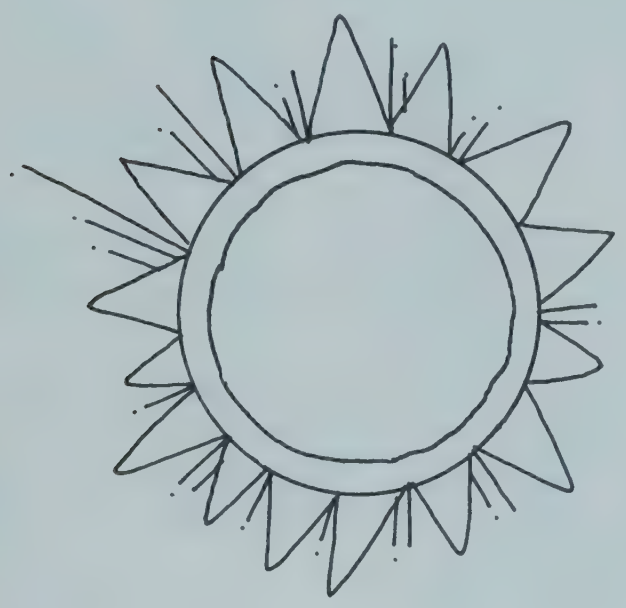
Additional Activity: Have students research other self-renewing cycles, such as the water cycle or the nitrogen cycle. Have them discuss how these cycles are examples of how nature recycles.

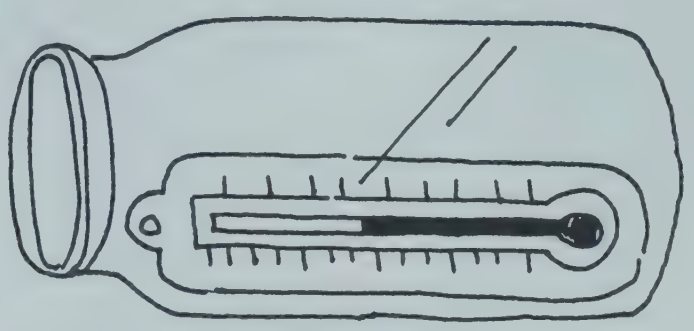
The CO_2 Effect

Concept: The greenhouse effect and global warming are caused by the trapping of heat by carbon dioxide (CO_2) in the atmosphere.

Materials: *For each group:* two thermometers and a clear glass jar with a cover.

Plan: Have students work in groups to see the greenhouse effect. Have one group member carefully place one thermometer in the glass jar. Have another member breathe into the jar, thereby increasing its concentration of CO_2, and carefully screw on the cover. Then tell students to put the other thermometer and the sealed glass jar on their sides on a sunlit windowsill. After ten to fifteen minutes, have students read the temperatures on the two thermometers. The thermometer in the jar should show a higher temperature due to the greenhouse effect.





Additional Activity: If possible, have students visit a local commercial greenhouse. Have them ask the manager to describe the differences in indoor and outdoor temperatures on a very cold day. Ask students to write an essay on either useful or destructive results of the greenhouse effect.

Skeletons–Inside or Outside?

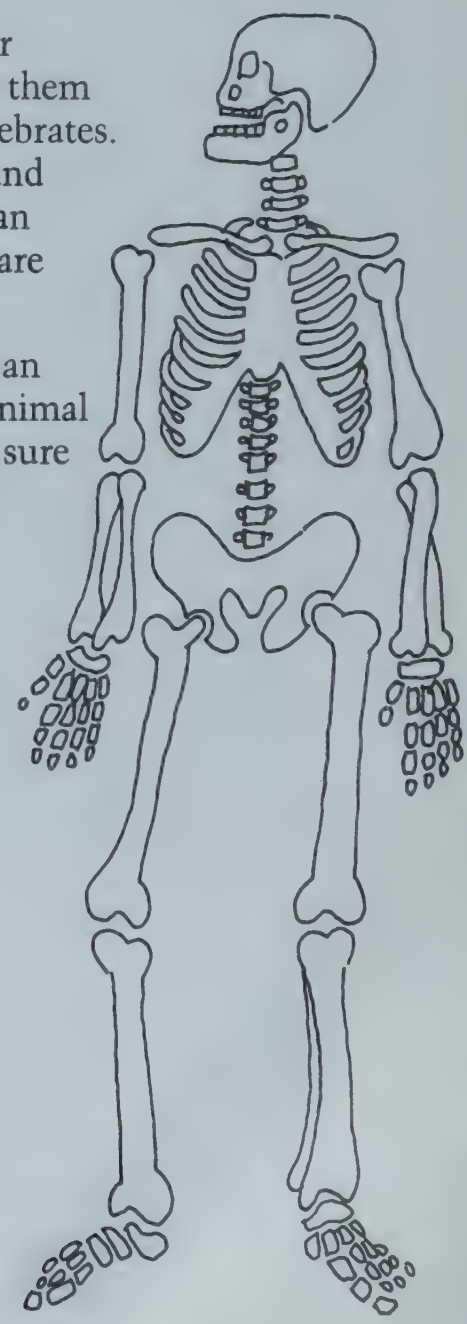
Concept: Animals are a large kingdom of living things. Animals can be divided into vertebrates (animals that have backbones) and invertebrates (animals that do not have backbones).

Materials: Picture of a human skeleton or a Halloween paper skeleton; cleaned lobster, shrimp, or crab exoskeleton (outside skeleton); shells from snails, clams, oysters, or mussels; old nature magazines; scissors.

Plan: Have students observe the skeletons, exoskeletons, and shells and then discuss the differences. Most students will conclude that skeletons are on the insides of bodies while exoskeletons and shells are on the outsides of bodies. Tell students that animals with backbones inside their bodies are called *vertebrates;* animals with "outside" skeletons or shells do not have backbones and are called *invertebrates.*

Have students work in groups to look in nature magazines for pictures of animals. Have them cut out the pictures and place them in two piles—one pile for vertebrates and the other for invertebrates. Although students may cut out more pictures of vertebrates and therefore may assume that vertebrates are more numerous than invertebrates, tell them that this is not the case. In fact, there are many more invertebrates on earth than there are vertebrates.

Additional Activity: Have students look at a picture or an actual skeleton of a fish or a snake. Ask them to classify the animal as a vertebrate or an invertebrate and to give their reasons. Be sure students do not complete this activity with the idea that only mammals are vertebrates.



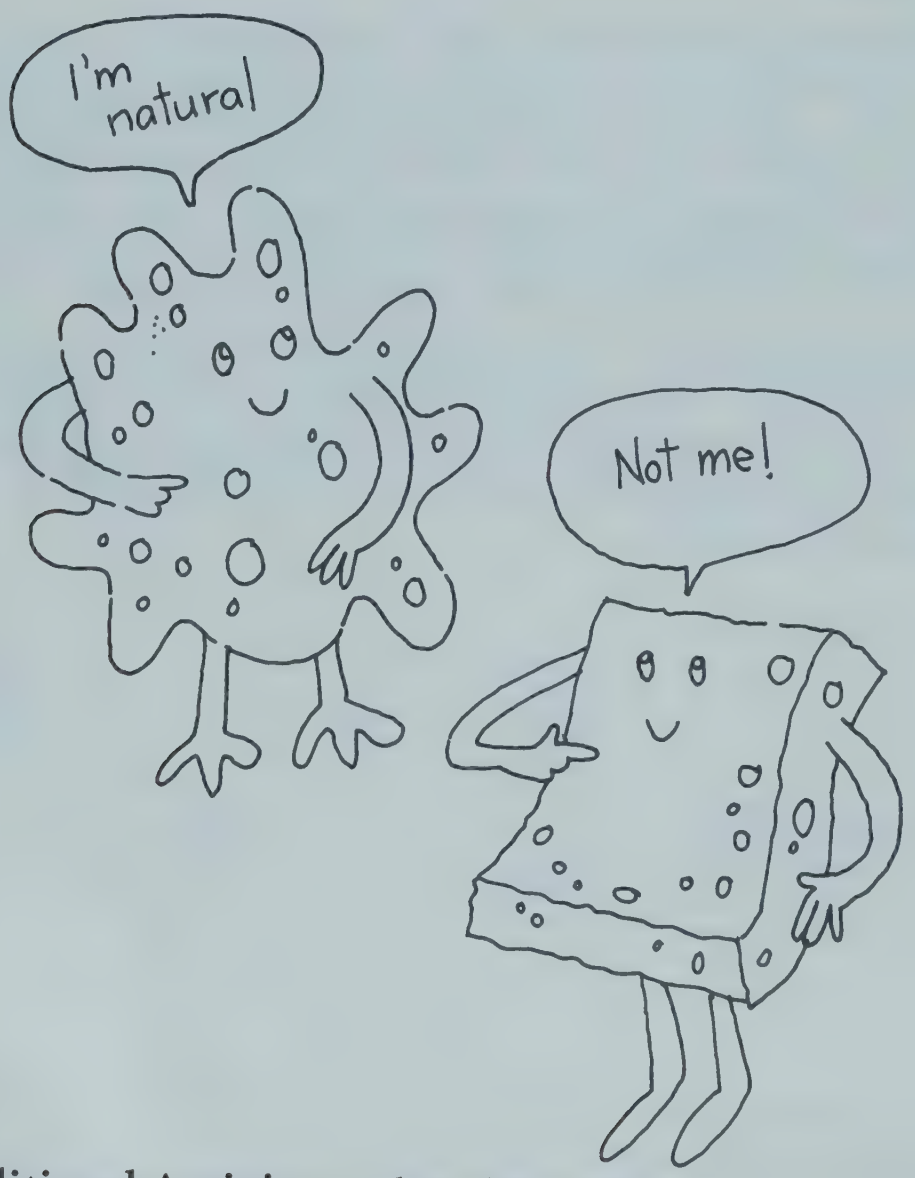
Soaking Up

Concept: Sponges are many-celled animals with specialized cell functions. Different cells of a sponge do different jobs.

Materials: *For each student:* natural sponge (the skeleton of a living sponge animal), synthetic kitchen sponge.

Plan: Many students may not realize that a natural sponge is the skeleton of an animal that was once alive. Explain that a living sponge takes food from the water in which it lives. The water containing food passes through the many holes, or pores, of the sponge.

Tell students to examine the natural sponge and the synthetic kitchen sponge, comparing them on the basis of appearance, texture, and odor. Have them discuss their observations.



Additional Activity: Ask students to think of other examples of manufactured objects that imitate those found in nature. Possibilities include plastic flowers, fake fur, and imitation leather.

Helpful Worms?

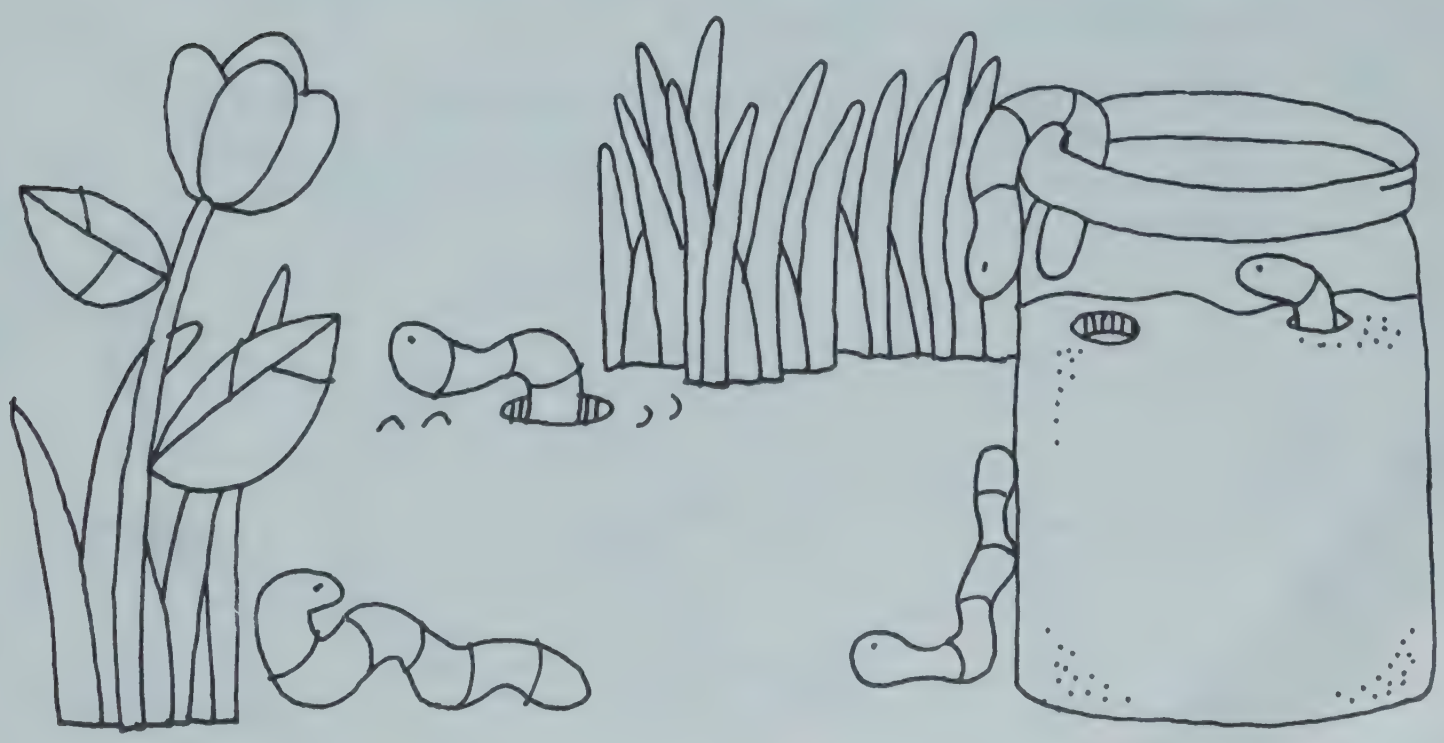
Concept: Flatworms, roundworms, and segmented worms are bilaterally symmetric (the right and left halves are mirror images of each other). They have heads and tails, and upper and under surfaces. Many worms are parasitic (live off other animals), but earthworms are helpful worms with an important role in agriculture.

Materials: Jar containing moist soil mixed with cornmeal and several earthworms.

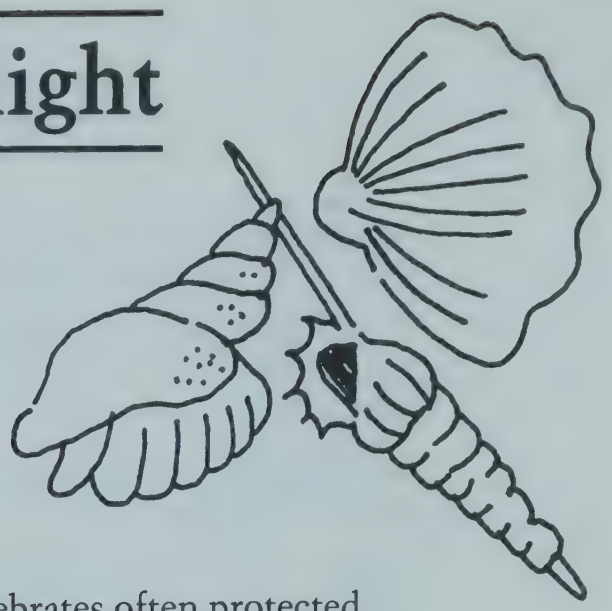
Plan: Tell students that earthworms aerate the soil. Explain that they bring minerals from the lower layers of soil to the upper layers, making the minerals more available for plant growth. The worms make the soil porous so that water and air can reach the plant roots. Ask students to observe the actions of the earthworms in the jar and to note what they see over the course of several days. Then have students draw before and after pictures of the soil in the jar or write a short essay entitled "A Day in the Life of an Earthworm" based on their observations.

Additional Activity: Charles Darwin estimated that earthworms bring eighteen tons (16.4 metric tons) of soil to the surface of one acre ($\frac{4}{10}$ hectare) of land in one year. Have students estimate how much soil is brought to the surface in one square foot (929 sq. cm) in one year.

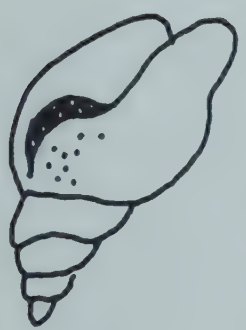
Answer: .0004 tons (366 grams) or 8 lbs (3½ kg).



Seafood Delight



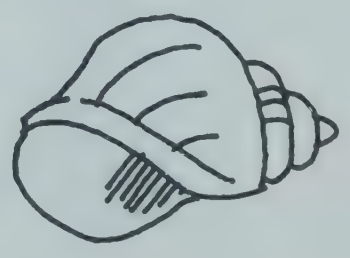
Concept: Mollusks are soft-bodied invertebrates often protected by a shell. Mollusks are a source of food and jewelry. However, some of them can be garden pests or a danger to deep-sea divers or swimmers.



Materials: As many of the following shells as possible: snail, conch, whelk, clam, mussel, oyster, scallop; index cards with the following names: clam, oyster, mussel, scallop, snail, whelk, conch, slug, squid, octopus, nautilus, cuttlefish.

Plan: Students will first observe the shells of the various mollusks. Then they will work with partners and select the name of a mollusk on which to report. Their reports should include a picture from a magazine or a drawing; whether the mollusk is classified as hatchet-footed, stomach-footed, or head-footed; whether the mollusk is a univalve or a bivalve; and whether it has an internal shell or no shell at all. After students have finished their reports, tell them to form three large groups representing the hatchet-, stomach-, and head-footed mollusks. Have students share with the class their findings for the mollusk group they represent.

Additional Activity: Pearls are made when sand or another irritant gets inside an oyster. The oyster secretes a pearl-like material around the irritant. Have students find out how cultured pearls are made.



A Success in the Animal Kingdom

Concept: Arthropods are the success of the animal kingdom. In biology, "success" means that the members of the group are found in many environments or in great numbers. Arthropods meet both conditions. Most arthropods have segmented bodies, an exoskeleton (a skeleton outside the body), and jointed legs.

Materials: Ant or a fly in a jar, lobster or crab exoskeleton, spider, centipede, and millipede in separate jars or a detailed photograph of each.

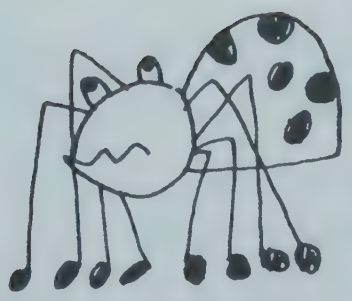
Plan: Tell students that they will observe members of the five classes of arthropods—insects, crustaceans, arachnids, centipedes, and millipedes. They will then record their observations.

Copy the following chart on the chalkboard and have students copy and complete it.

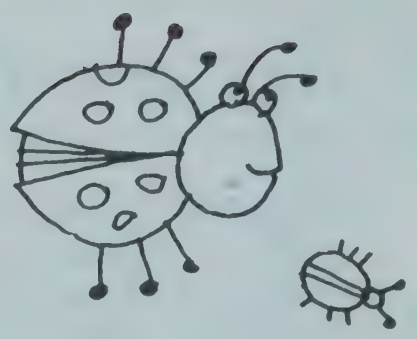
Arthropod	Number of Main Body Parts or Segments	Number of Pairs of Jointed Legs
Insect		
Crustacean		
Arachnid		
Centipede		
Millipede		

Students should find the following:

Insect	3	3
Crustacean	2-3	5-10
Arachnid	2	4
Centipede	about 15	1 per segment
Millipede	30 to 40	2 per segment



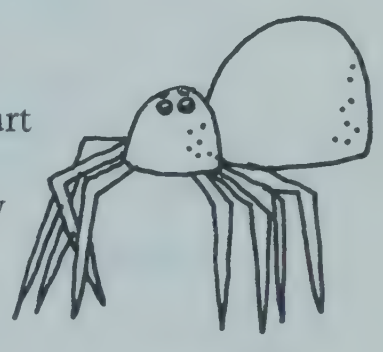
Build a Bug

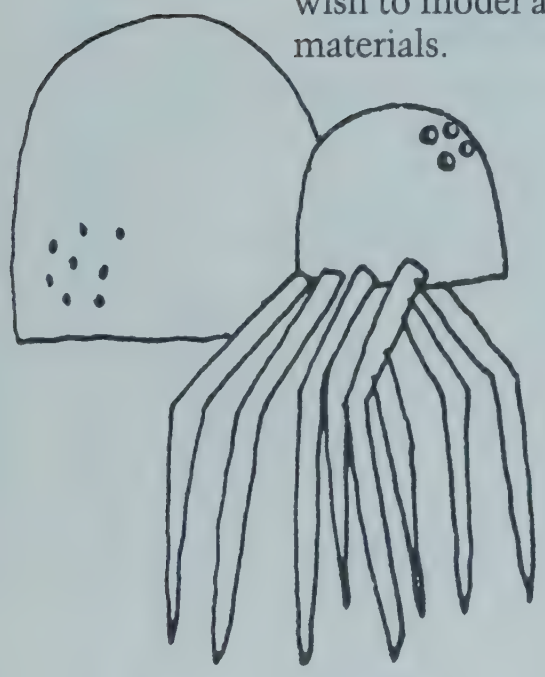


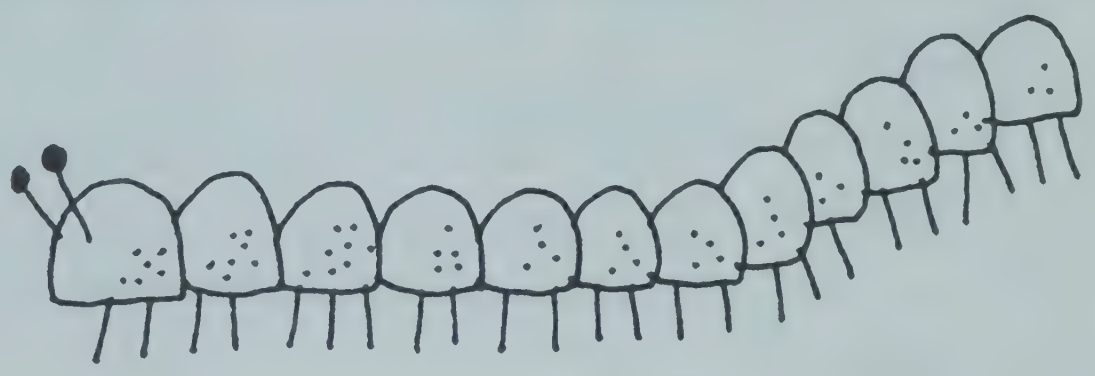
Concept: Arthropods have different numbers of body parts and different numbers of jointed legs.

Materials: *For each student:* wooden toothpicks of different colors; several bags of gumdrops of different colors, sizes, and shapes.

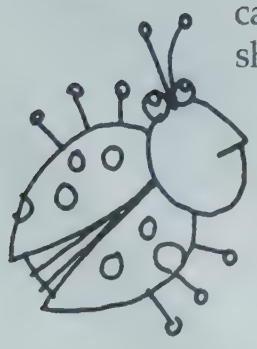
Plan: Have students use the information from their charts on arthropods to build arthropods from gumdrops and toothpicks. Remind students to use the correct number of body parts and the correct number of jointed legs and to attach them to the correct part of the body. They may need to use magazines, science books, or encyclopedias to research their chosen "bugs." Some students may wish to model antennae, wings, and other parts with available materials.

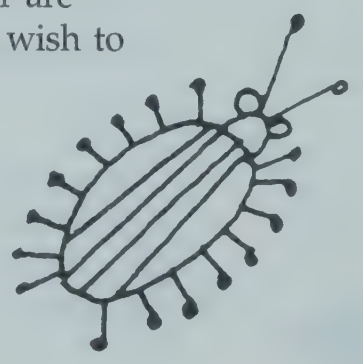






Have each student exhibit his or her arthropod and let other students decide whether it is an insect, arachnid, centipede, or millipede. After identifications have been made, you may want to let your students eat their "bugs." Be sure toothpicks and other inedible matter are carefully removed first. Centipede and millipede makers may wish to share their treats.



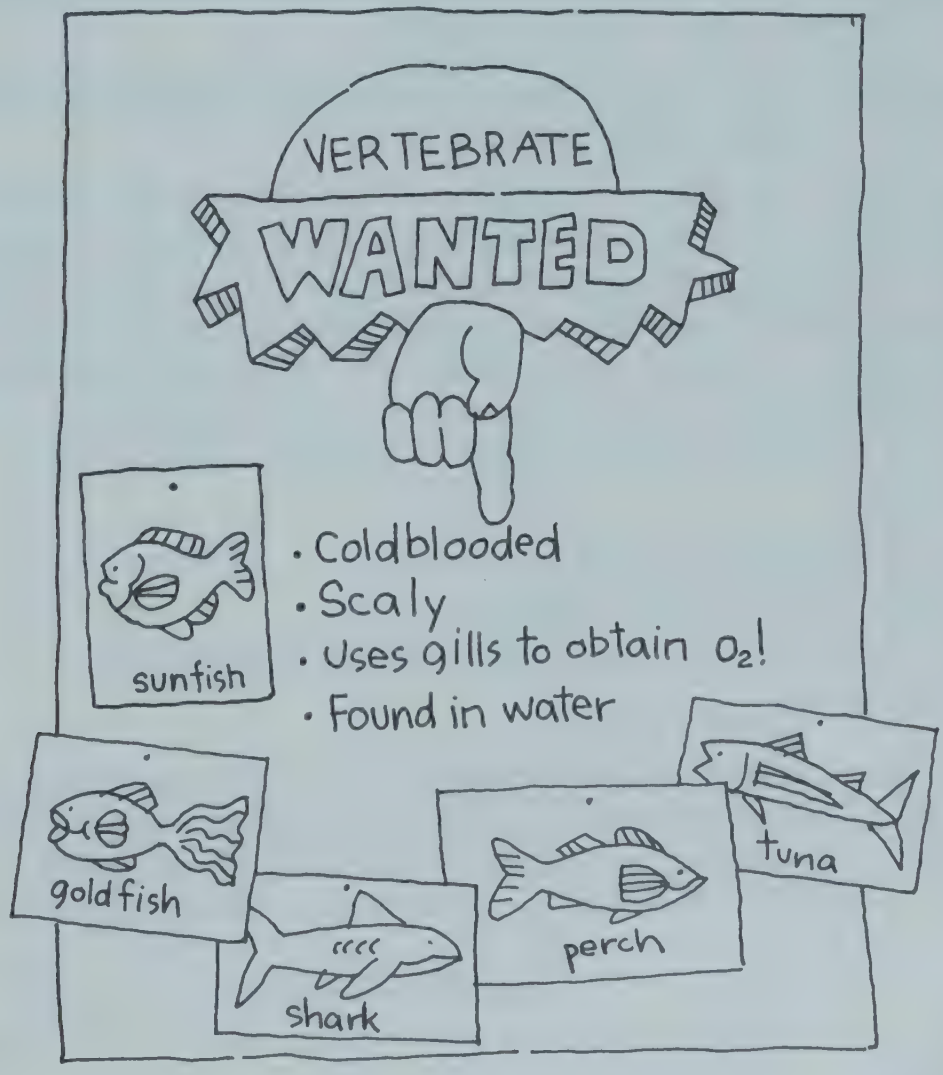


Boning Up

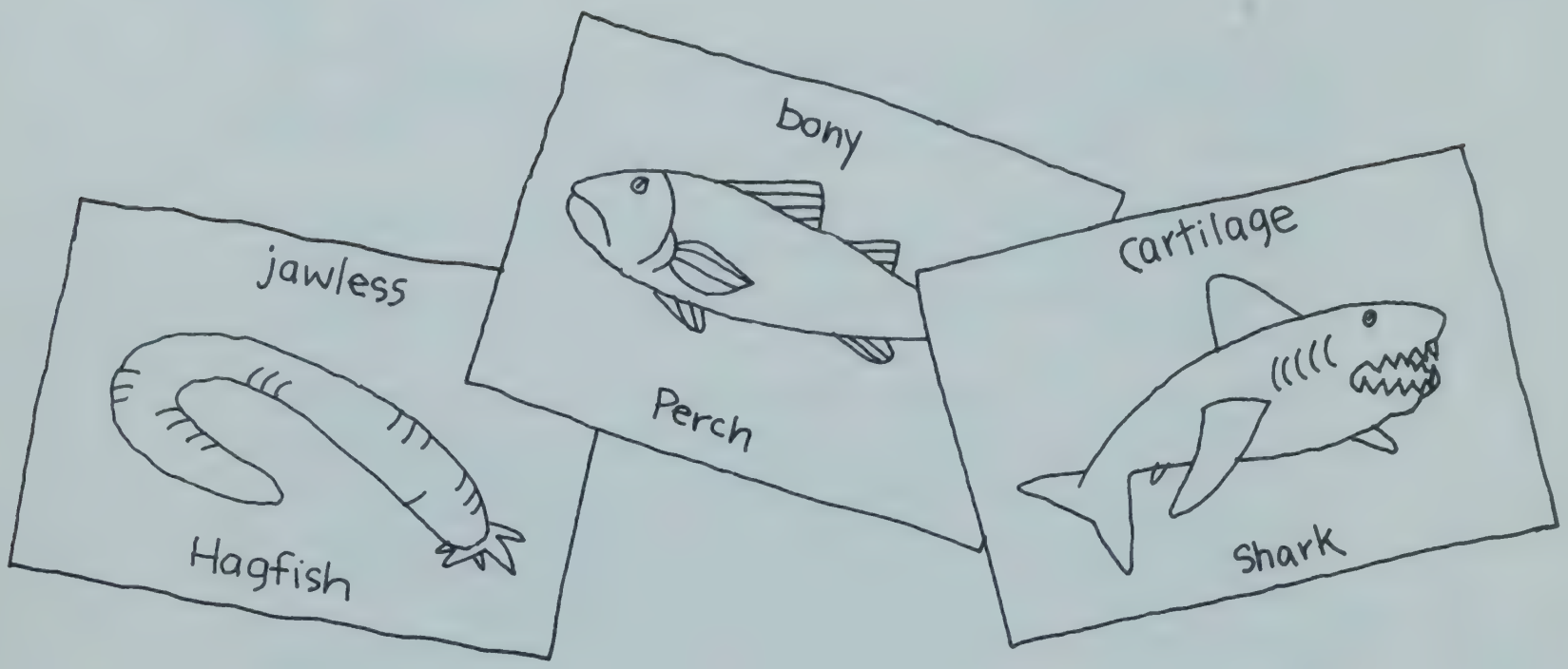
Concept: A vertebrate gets its shape from its endoskeleton (a skeleton inside its body). A backbone is an important part of this skeleton. Vertebrates are classified into five groups.

Materials: *For each group:* bones or photographs or diagrams from each of the five groups: fish, amphibians, reptiles, birds, and mammals (available at a biological supply house); large sheets of poster paper.

Plan: Divide the class into five groups and have them examine the vertebrate bones for similarities and differences. Assign one type of vertebrate to each group. Have each group make a Vertebrate Wanted poster for its type of vertebrate. The poster should list characteristics of the vertebrate, such as a description of its usual habitat, a description of its body covering, whether it is warmblooded or coldblooded, its preferred foods, its ways of moving, and so on. After the groups have completed their posters, display them. Encourage the entire class to find photographs and drawings of appropriate vertebrates to be attached to each poster.



Go Fish!



Concept: Fish are coldblooded vertebrates found in water. Fish can be classified as jawless fish, cartilage (tough but flexible tissue) fish, or bony fish. Most fish are bony fish.

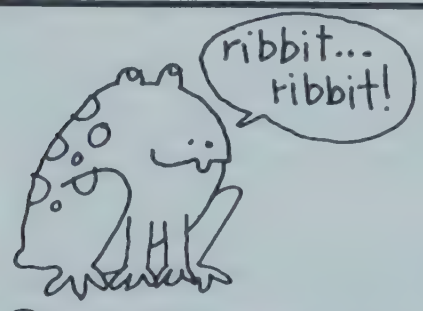
Materials: *For each group:* several magazines with pictures of fish, thirty-six index cards, pens or pencils.

Plan: Divide the class into groups of four students each. Tell them that in order to identify the classes in which different fish belong, they will construct a set of Go Fish cards and play Go Fish. Have students cut out or draw pictures of fish from each of the three classifications: jawless, cartilage, or bony. A possible breakdown for the thirty-six cards is: ten jawless, ten cartilage, sixteen bony. Examples of fish that represent each classification include the following:

- jawless: lamprey, hagfish
- cartilage: various sharks, skates, rays
- bony: salmon, goby, trout, perch, goldfish, butterfly fish, porcupine fish

Players sit in circles. Each gets five cards. The remaining cards are placed in a pile in the center. The object of the game is to get a full set (four) of one class of fish. The first player asks the player to the right for a fish class—jawless, bony, or cartilage. If that player has it, he or she must give it to the player who asked. If not, he or she says "Go fish" and the player who asked draws from the pack. If the draw is successful, the player who asked gets another turn. The first player to get a full set of one class of fish wins.

"I Led Two Lives" by Ima Frog



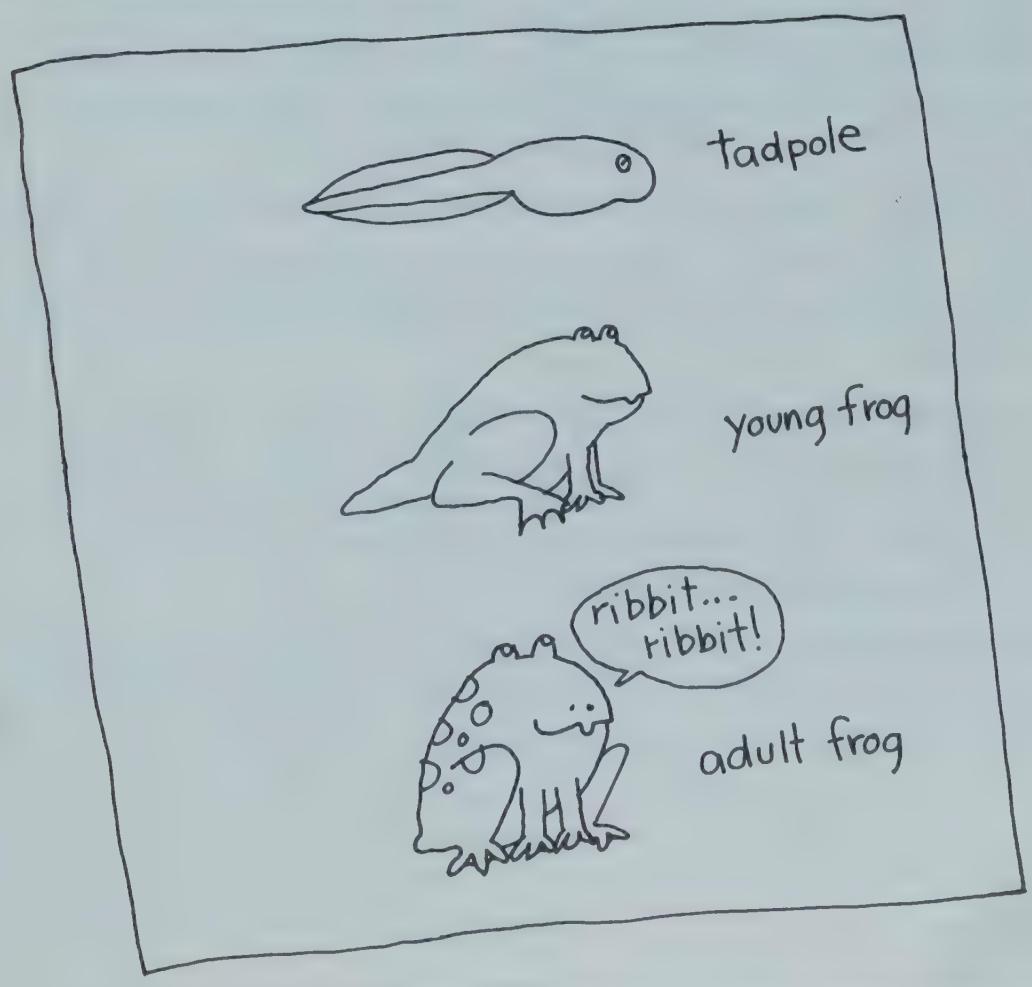
Concept: Frogs, toads, salamanders, and newts are coldblooded vertebrates called amphibians. Although adult amphibians live on land, they reproduce in water.

Materials: *For each group:* several tadpoles in an aquarium.

Plan: To enable students to study the life cycle of an amphibian, namely, the frog, have them place tadpoles in an aquarium. Have students observe the metamorphosis (distinct change from tadpole to frog). Students should also observe some traits of frogs such as the following:

- thin, moist skin
- tails that disappear as tadpole becomes an adult frog
- four legs—two short front legs, two powerful hind legs used for jumping

Students may enjoy drawing pictures of the tadpoles, young frogs, and adult frogs.



Descendants of Dinosaurs

Concept: The reptile class of vertebrates consists of four main groups: crocodiles, turtles, lizards and snakes, and the tuatara (a reptile that lives on islands off the coast of New Zealand and is considered a living fossil). Reptiles differ from amphibians in that reptiles have dry, scaly skin and reproduce on land.

Materials: Terrarium containing a nonpoisonous snake or lizard.

Plan: Tell students that dinosaurs roamed the earth over 200 million years ago and that their descendants can be observed today in a terrarium.

Have students observe the snake or lizard in the terrarium over a period of time and plan a description of the animal and its habitat. Notes should include what its skin is like, what it eats, how and when it sleeps, what seems to please or annoy it. Have students research how reptiles reproduce.

Additional Activity: If students have completed the activities on pages 25–27, have them list similarities and differences for the coldblooded vertebrates: fish, amphibians, and reptiles.

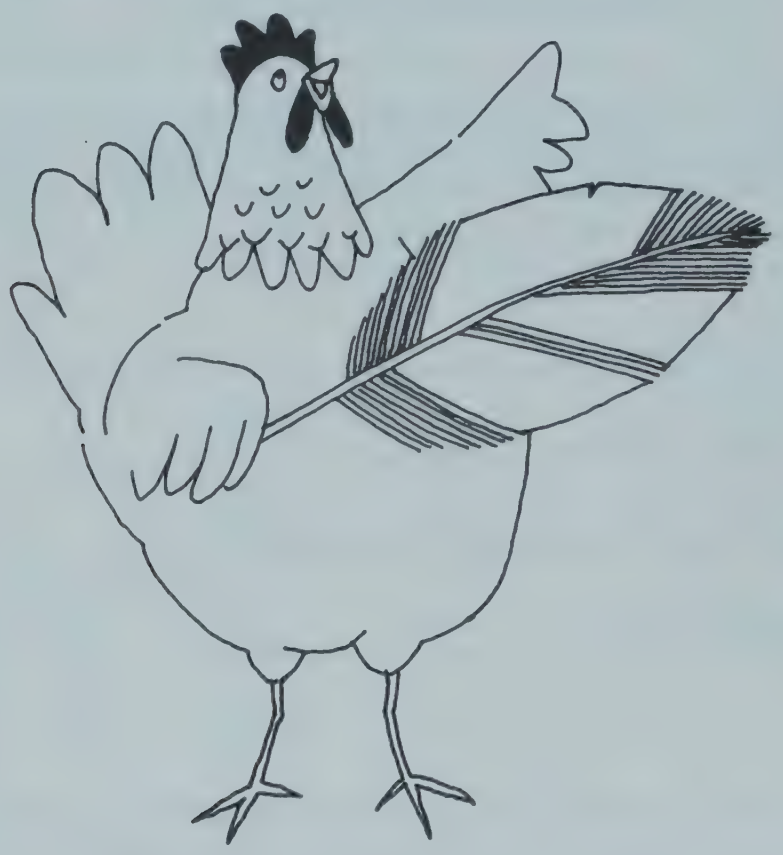
This Is for the Birds!

Concept: Birds are warmblooded vertebrates with wings and a body covering of feathers. Birds have low body weights and high energy. These traits are adaptations for flight.

Materials: *For each group:* down (short, fluffy, insulating feathers) and contour feathers (large feathers that help give a bird a streamlined shape), chicken bones, knife.

Plan: Students will observe the differences in down and contour feathers and will discover their different purposes. Students will also observe the hollow-with-support structure of a chicken bone and realize that air-filled bones make the skeleton of a bird very light.

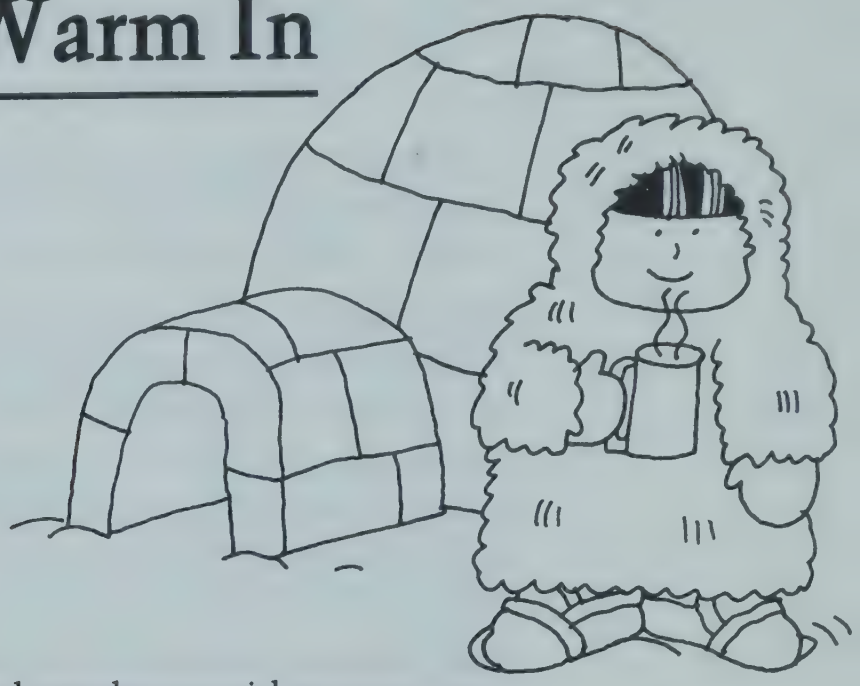
Have students locate the shaft and vane of a contour feather. Then have students draw and label both contour and down feathers. Have students discuss the role of each kind of feather. Some students may mention that down is used in jackets and quilts for insulation.



Next, under your close supervision, have students carefully cut a chicken bone in half and observe the hollow cavity. Explain that hollow bones make light skeletons.

Additional Activity: Have interested students separate strands of contour feathers. They should notice the locking feature of individual strands called barbs. Explain that birds spend a great deal of time preening, or aligning, these barbs. Have students watch for birds that are in the process of preening.

Chill Out, Warm In



Concept: Mammals are warmblooded vertebrates with mammary glands that provide food for their young.

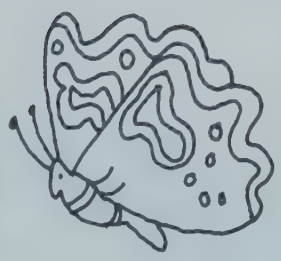
Materials: *For each group:* large bowl of ice water, alcohol thermometer, forehead thermometer, towel.

Plan: Remind students that body temperatures of warmblooded vertebrates do not usually change in reaction to outside temperatures except in extreme circumstances. Put the following chart on the chalkboard and have students copy it in their notebooks or on separate sheets of paper.

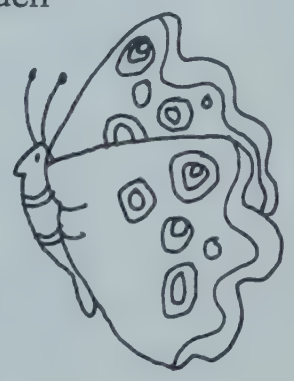
Internal Temperature 1: _____
Temperature of Ice Water: _____
Skin Temperature After Being in Ice Water: _____
Internal Temperature 2: _____

Have students measure and record their internal temperatures using the forehead thermometer. Next have them measure and record the temperature of the ice water using the alcohol thermometer. Then have students place their elbows in the ice water for about five minutes, quickly dry off the water, and use the alcohol thermometer to take and record their skin temperature near the elbow. Students should now use the forehead thermometer to retake and record their internal body temperature. Internal body temperatures should be the same, since humans are warmblooded. Explain that the internal temperatures of coldblooded animals would change after such a procedure.

Animal Camouflage



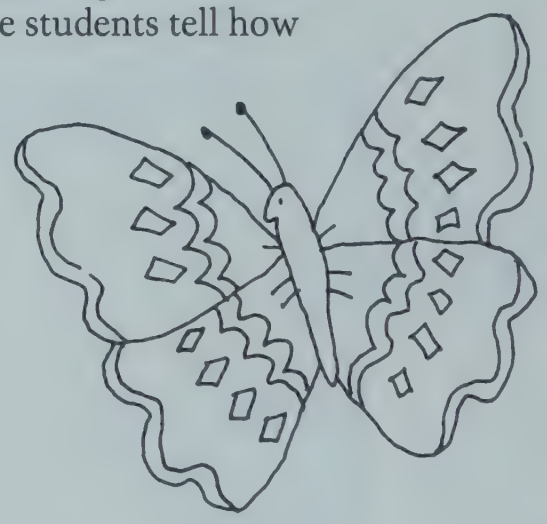
Concept: Animals adapt to their environments. Certain traits such as body coloring and markings, special body parts, and certain actions make an animal better adapted to its environment.

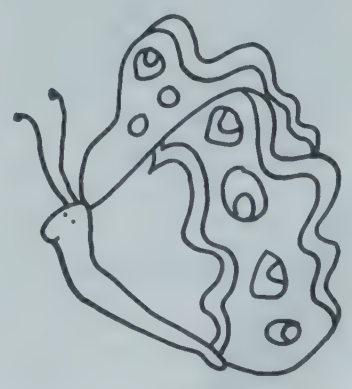


Materials: *For each pair:* several sheets of wrapping paper of three different kinds (one patterned and the other two of different solid colors), scissors, timer.

Plan: Tell students that protective coloring helps many animals hide from predators. To show this, have students cut out twelve butterflies from the patterned paper and twelve from each of the solid papers. Then have one student in each pair place one full piece of patterned paper on the floor and on it carefully place the thirty-six butterflies, color or pattern side up. Have the partner cover his or her eyes. Set the timer to ten seconds. Tell the partner to uncover his or her eyes and pick up, one at a time, as many butterflies as is possible in the time allotted. Pairs should count the number of butterflies of each type that are "captured." Have students speculate on the results.

Additional Activity: Repeat the experiment using solid-colored wrapping paper for the base or background. Have students tell how the results differ.



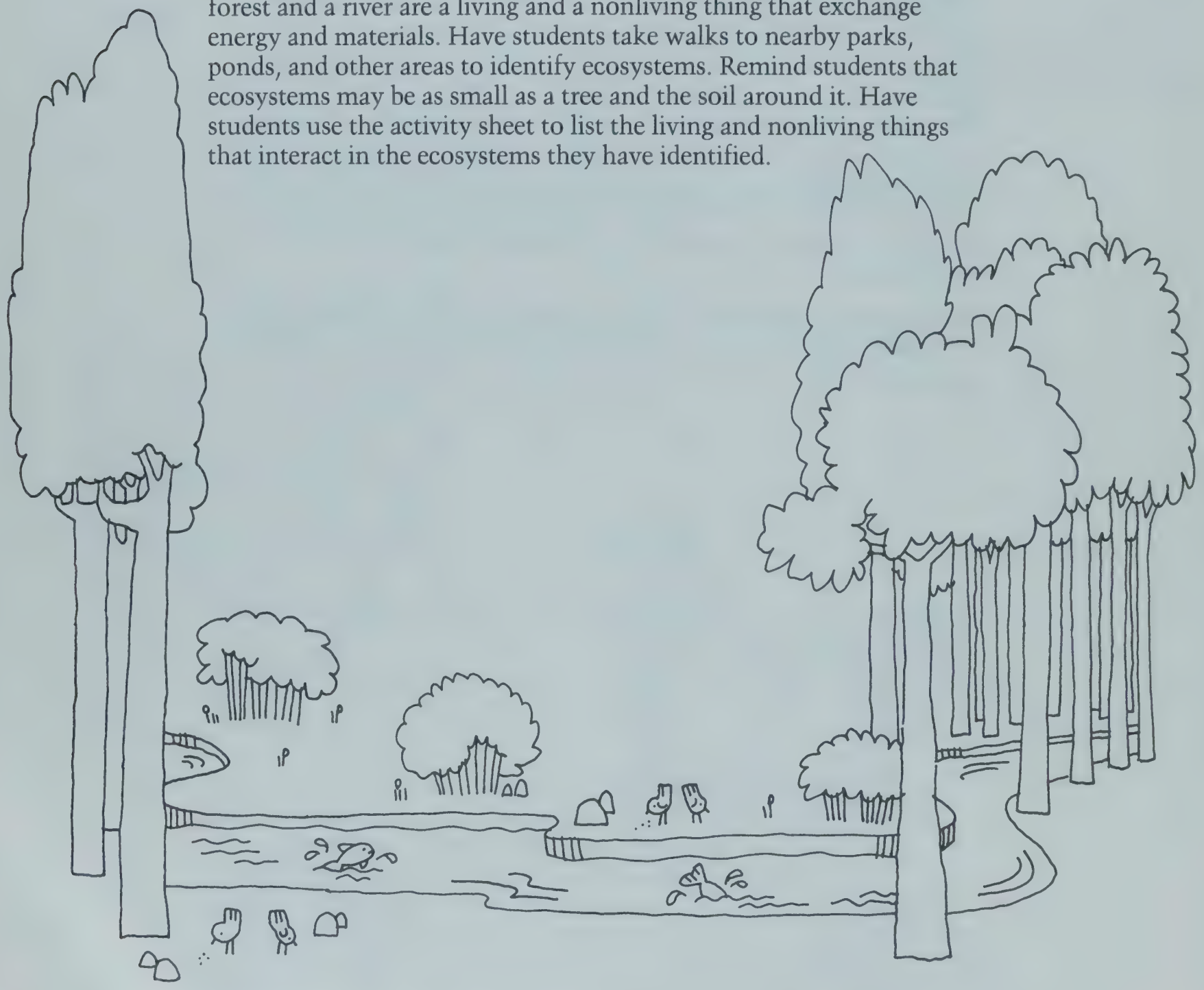


It's a Small World

Concept: An ecosystem is a distinct community of interactive living and nonliving things. Small ecosystems can be parts of larger ecosystems.

Materials: Magazine pictures showing ecosystems; *for each student:* activity sheet (page 33).

Plan: Display the pictures showing ecosystems as you explain to students that examples of ecosystems are all around. For example, a forest and a river are a living and a nonliving thing that exchange energy and materials. Have students take walks to nearby parks, ponds, and other areas to identify ecosystems. Remind students that ecosystems may be as small as a tree and the soil around it. Have students use the activity sheet to list the living and nonliving things that interact in the ecosystems they have identified.



Additional Activity: Have students prepare a classroom terrarium that is an ecosystem. Have students list the living and nonliving things that interact.

Name _____ Date _____

It's a Small World

Ecosystem:

Living things:	**Nonliving things:**

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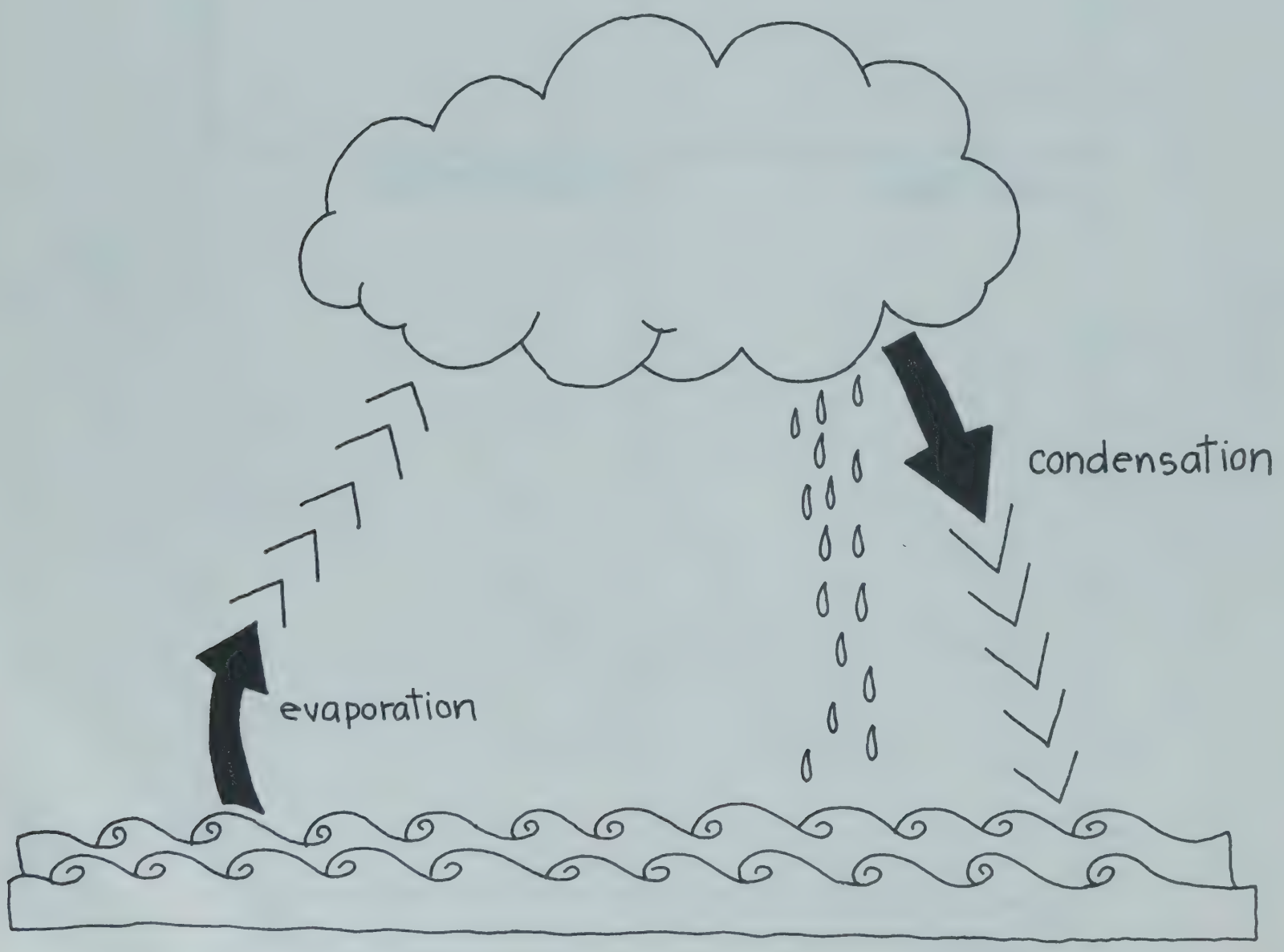
The Water Goes Round and Round

Concept: A water cycle is the movement of water through an ecosystem.

Materials: Clear glass pot with cover, hot plate or other heat source, water, ice cubes, heat-resistant beaker, pot holder or mitt.

Plan: Inform students that the water cycle of evaporation, condensation, and precipitation can be easily modeled. Fill the glass pot about halfway with water, cover it, and bring it to a boil. Place ice cubes in the beaker and carefully put the beaker on the cover of the pot, using a pot holder or mitt. The water cycle is exhibited as water boils and evaporates, forming water vapor that condenses in the presence of ice, and precipitates, or drips, back into the pot.

Have students write and illustrate a short essay or poem on the journey of water through an ecosystem. Remind students that most water cycles are more complex than the one just modeled.

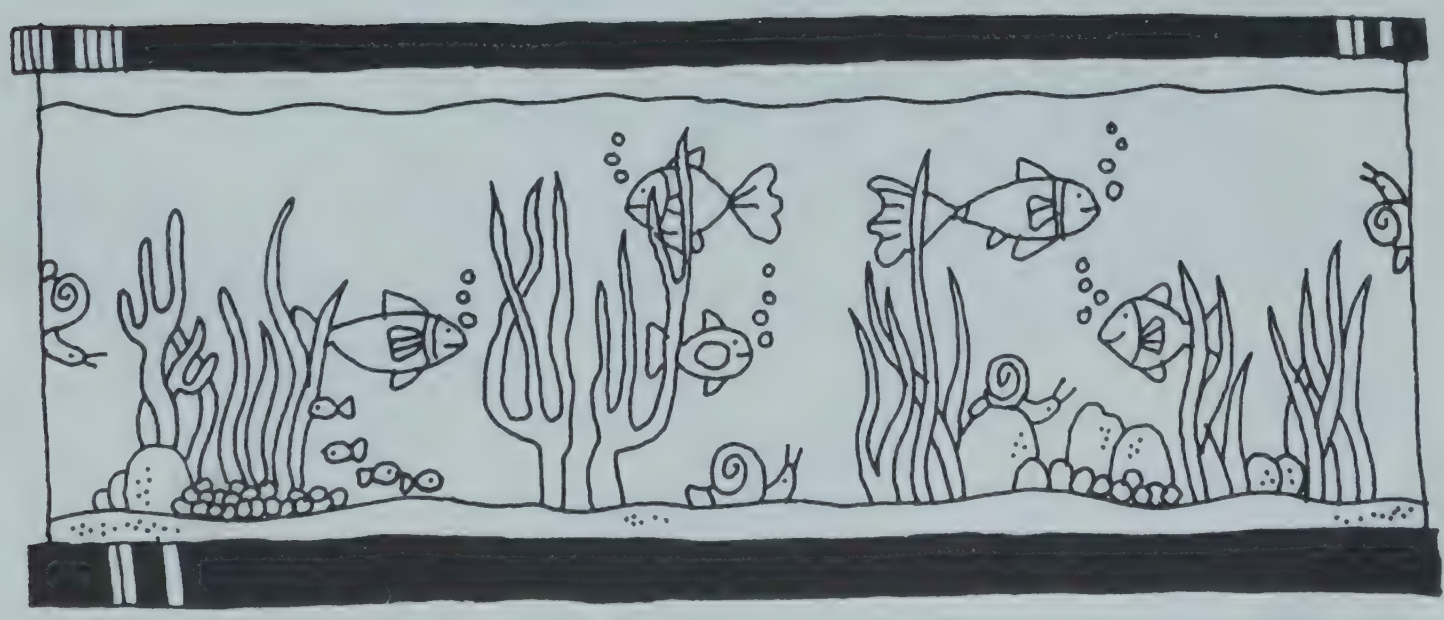


Living in a Fishbowl

Concept: An aquarium is an ecosystem that contains several life forms and also nonliving matter.

Materials: 3- to 10-gallon (11 ½- to 38-L) fish tank; water that has been allowed to sit for a day in an open container; sterilized sand or gravel and small stones; water plants such as elodea, fanwort, and eelgrass; snails; small fish such as guppies; tadpoles.

Plan: Explain to students that setting up and maintaining an aquarium will allow them to observe an ecosystem at work. Have students cover the bottom of the aquarium with sand to a depth of about 1 inch (2 1/2 cm). Have them add a few small rocks or stones and fill the aquarium with water to about 1 1/2 inches (4 cm) from the top. Next, they should add the water plants, about five per gallon (3 3/4 L) of water, and anchor the roots in the sand. Let the aquarium settle for a day before having students add two snails per gallon (3 3/4 L) of water. On the next day, tell students to add two fish per gallon (3 3/4 L) of water. Several tadpoles may also be added. Place the aquarium in north or west light. As students observe the aquarium, they should add to the water level water that has aged. They should also feed the fish a small amount of fish food each day. If all the food is not consumed, they should feed a lesser amount. If necessary, water fleas can be added to control algae. Have students keep a log of what they observe in the aquarium over the course of several weeks.



Which Biome Is Home?

Concept: A biome is a large group of ecosystems with similar climates or conditions. The biomes of the United States are the tundra, the taiga, the deciduous or coniferous forest, the rain forest, the grasslands, and the desert.

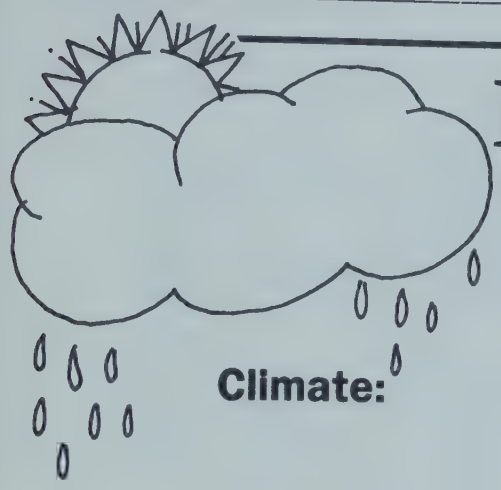
Materials: *For each student:* activity sheet (page 37).

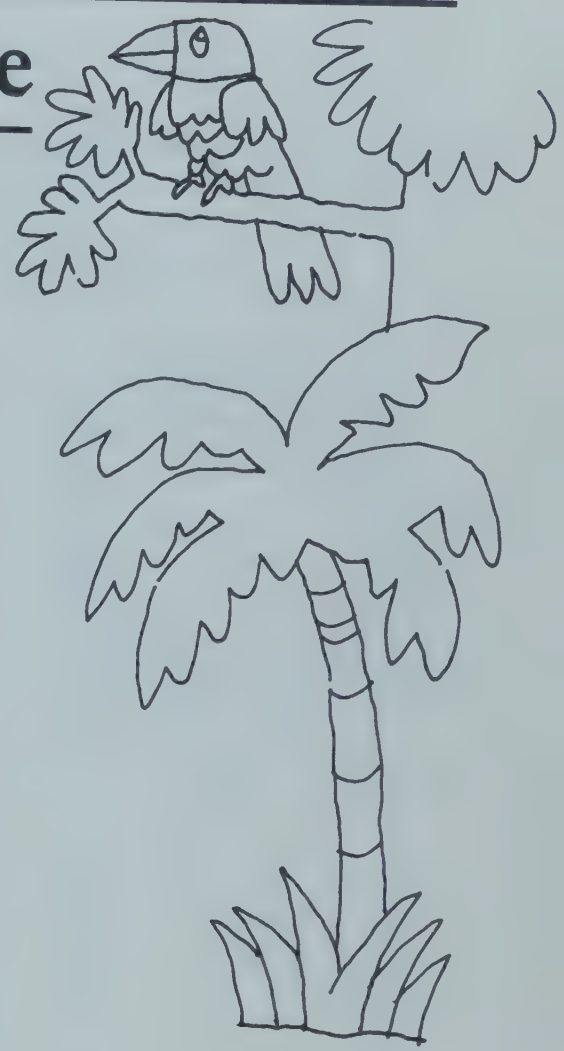
Plan: Discuss the general concept of biomes with students. Have students locate a map of North America or the United States in which biomes are indicated. Ask students to determine in which biome they live. Have students use the activity sheet to record the climate, plants, and animals in their biome. Have them include statistics such as annual precipitation, soil type, observations of plant and animal life, effects of humans on the biome, ecological problems, and possible solutions to these and other problems. Encourage students to use encyclopedias, almanacs, and other reference sources if necessary to complete the activity sheet.

Additional Activity: Have groups of students research other biomes besides their own home biome and fill out a copy of the activity sheet for them. Have the class share and compare the biomes of the United States.

Name _____ Date _____

Biome, Sweet Biome





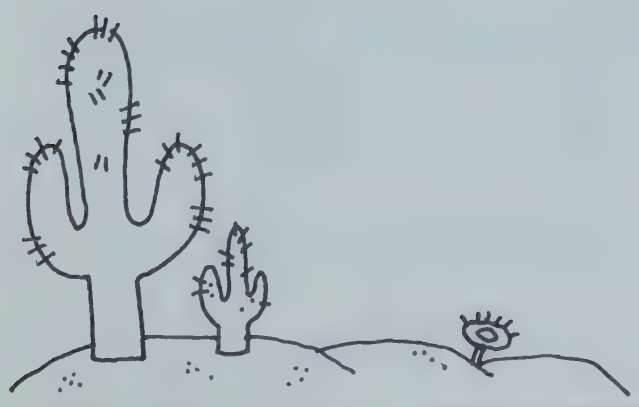
Climate:

Plants:

Animals:

Problems:

Solutions:



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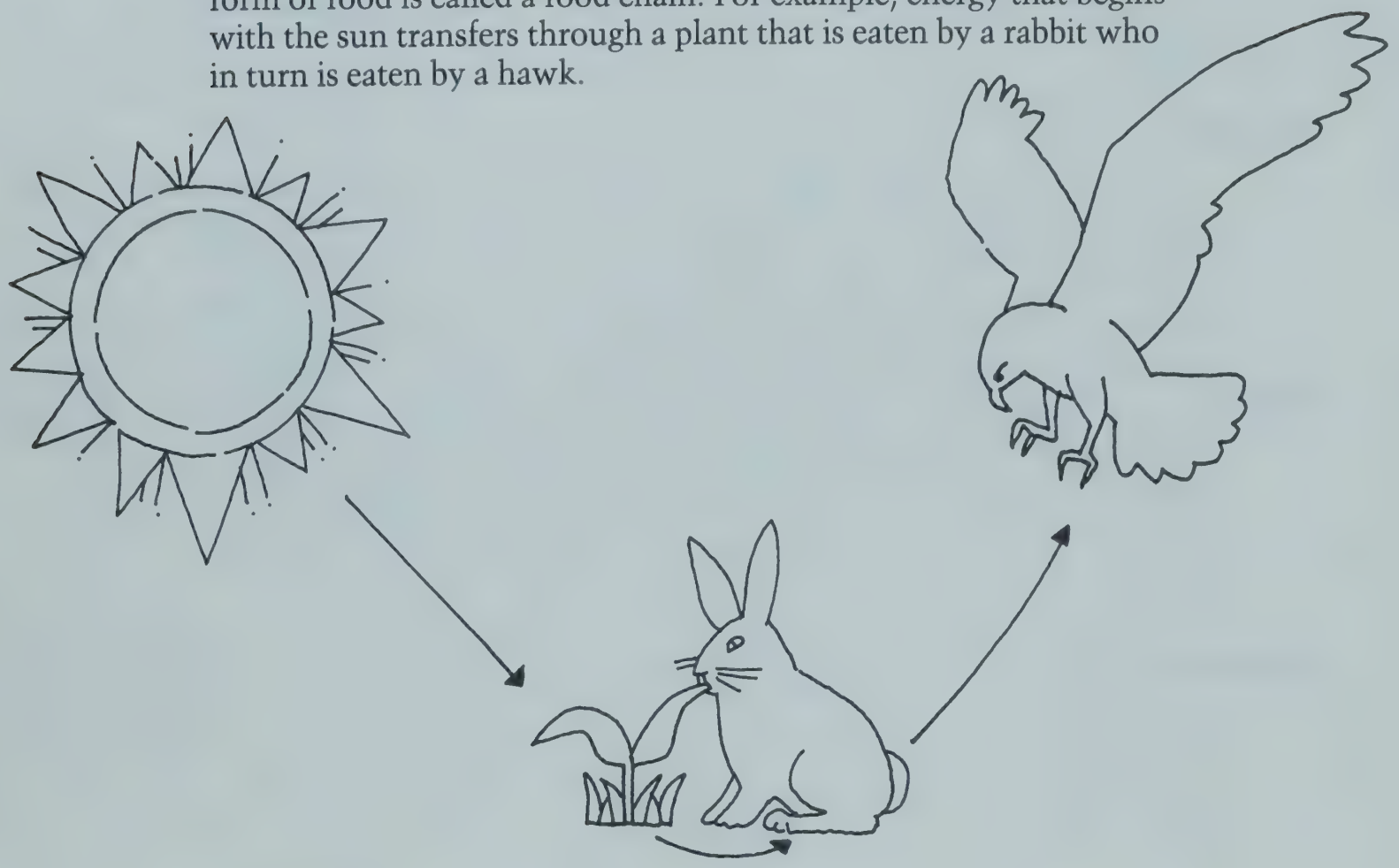
From the Sun

Concept: The transfer of energy from organism to organism in the form of food is called a food chain. For example, energy that begins with the sun transfers through a plant that is eaten by a rabbit who in turn is eaten by a hawk.



Materials: *For each student:* activity sheet (page 39).

Plan: Tell students that they are going to trace their meals to the sun. Have students use the activity sheet to trace the sources of the food they ate for breakfast, lunch, or dinner. Have them determine whether animal-based or plant-based foods follow a more complex chain to reach human consumption. Remind students that they have done part of the food chain activity on page 11. Be sure students trace various ingredients in food products with many sources, such as a taco or pizza or even a hamburger on a bun. Remind students that for many foods they will not be able to fill in all the columns. A portion of the completed activity sheet might be:

Food **A**	Source of A **B**	Source of B **C**	Source of C **D**	Energy Source **E**
milk	cow	grass	—	sun
cereal	grains	—	—	sun

Name _____ Date _____

Food **A**	Source of **A** **B**	Source of **B** **C**	Source of **C** **D**	Energy Source **E**

Conclusions:

1. Which food chains are the most complex on your chart? Why? _____

_____

2. What is the energy source for all food chains? _____

_____

3. Do any of your food chains show overlap? If so, which ones? _____

_____

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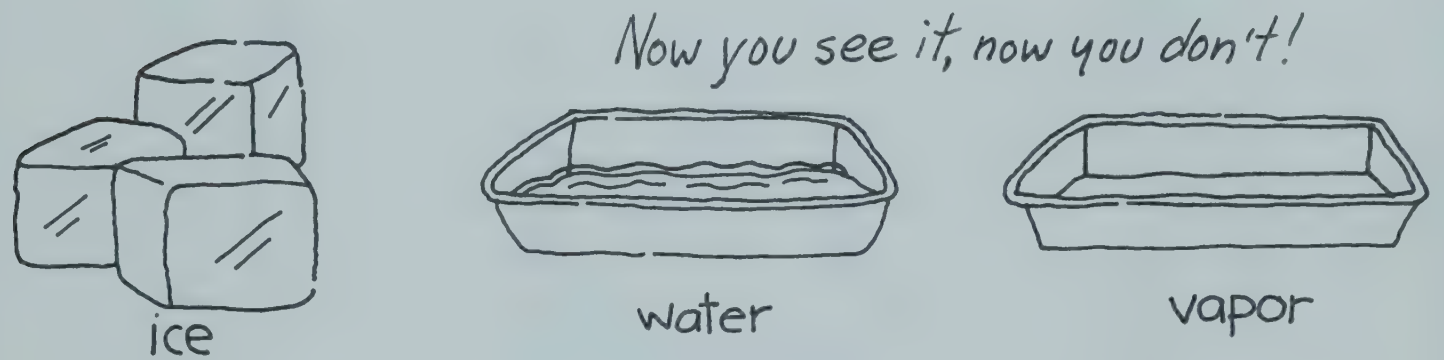
What's the Matter?

Concept: Matter is anything that has mass and takes up space. Matter is composed of molecules that are in turn made up of atoms. Most matter on earth is found in three states: solid, liquid, and gas. Matter can be changed from one state to another.

Materials: *For each group:* bag of ice cubes, plastic dishpan, heat source such as a hot plate, pot.

Plan: Tell students that they can help change the states of matter and that today they will do so for water molecules. Let students devise their own methods to change the ice (solid) to water (liquid) to water vapor (gas). Be sure they understand that no new material is formed, nor is any material lost in this process. Students may have the most difficulty understanding this principle when they change water to water vapor by evaporation or by heating.



Have groups of students list characteristics of solids, liquids, and gases from their experiment. You may want to draw the chart below on the chalkboard to help students organize their responses. Encourage students to recognize that solids have a definite shape and volume, liquids have a definite volume and take the shape of their container, and gas has neither a definite volume nor shape.

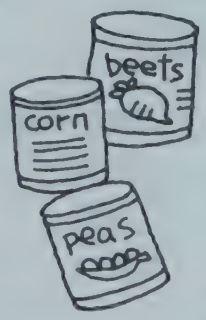
Ice, Water, Vapor

State	Shape?	Volume?	Visibility?
Solid			
Liquid			
Gas			

Let's Go on an "Element Hunt"

Concept: Matter is either a mixture or a substance. Substances are of two types: elements and compounds. Elements are substances that cannot be simplified by ordinary means such as heating or cooling. There are over 100 elements, most of which come from natural sources.

Materials: *For each group:* list of elements or copy of a periodic table of elements.

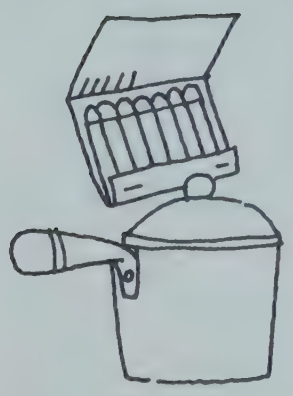


Periodic Table of the Elements

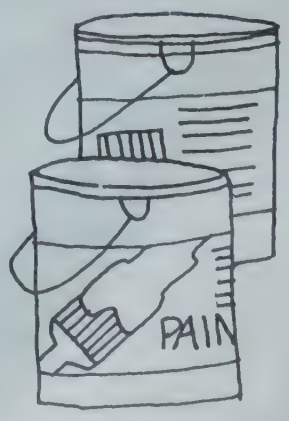
Chemical symbol
Atomic number
Element name
27 Co
Cobalt

	1A												3A	4A	5A	6A	7A	8A
1	1 H Hydrogen	2A																2 He Helium
2	3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
3	11 Na Sodium	12 Mg Magnesium	3B	4B	5B	6B	7B	8B			1B	2B	13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
4	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
5	37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
6	55 Cs Cesium	56 Ba Barium	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon	
7	87 Fr Francium	88 Ra Radium	104 Unnilquadium	105 Unnilpentium	106 Unnilhexium	107 Unnilseptium	108 Unniloctium	109 Unnilenium										

57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium



Plan: Tell students that they are going on an "Element Hunt," looking for common items that contain elements such as silver, gold, iron, nickel, copper, mercury, zinc, calcium, sodium, potassium, carbon, iodine, sulfur, neon, fluorine, aluminum, and boron. Encourage students to check cereal boxes, jewelry, and cleaning compounds (carefully) to locate items containing elements. Remind students that some elements do not occur in nature but instead have been produced by scientists in laboratories. Prepare a master list showing all the elements the class found.

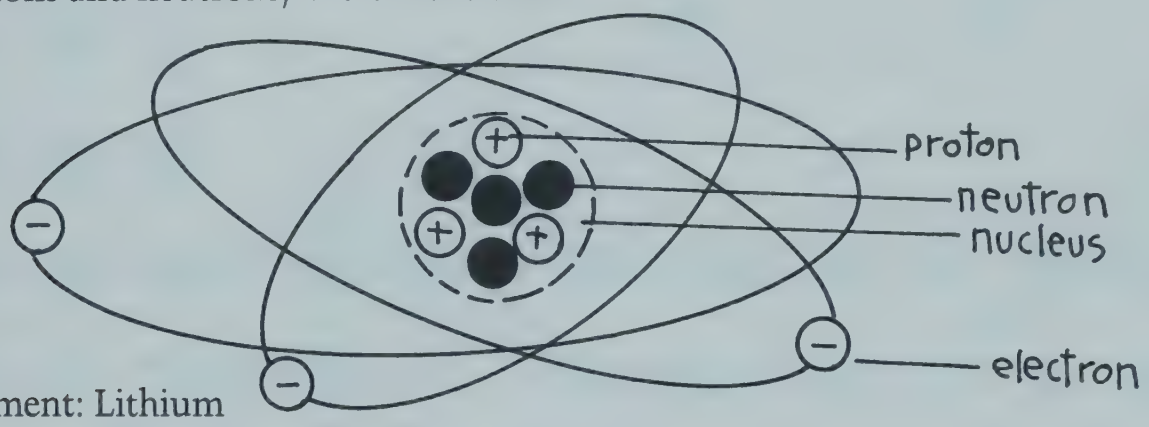


Atoms Are Partic-ular!

Concept: All matter—whether gas, liquid, or solid—is made up of atoms. The atoms of an element cannot be broken into anything simpler by ordinary chemical processes. However, there are models for parts within an atom.

Materials: *For each student:* toothpicks, several gumdrops of different colors, activity sheet (page 43).

Plan: Explain to students that they are going to make models of atoms. Tell them that each atom (except hydrogen) has three kinds of particles: *protons* (positively charged particles), *electrons* (negatively charged particles), and *neutrons* (particles with no charges). The number of protons and electrons in each atom are the same. The electrons surround the nucleus (center made up of protons and neutrons) in a diffuse cloud.



Element: Lithium
3 electrons, 3 protons, 4 neutrons

Have students use chemistry books or periodic tables to find the number of protons, neutrons, and electrons for different elements. Tell them to use the toothpicks and gumdrops to make models of these elements. Be sure students make a compact nucleus of protons and neutrons and let the electrons "orbit" on toothpicks. Some elements to consider are shown in the chart below:

Element	Protons	Electrons	Neutrons
H Hydrogen	1	1	0
He Helium	2	2	2
C Carbon	6	6	6
O Oxygen	8	8	8

Have students draw diagrams of their models and label them with the name of the element. Then have them use the activity sheet to discover the chemical makeup of different compounds.

Name _____ Date _____

Compounding the Matter

Compounds are combinations of different elements. Although there are only a few more than 100 elements, there are several million compounds. Below, a list of common compounds is started for you. Find some other compounds and research and record their chemical composition.

Compound	**Chemical Formula**	**Elements That Make the Compound**
Water	H_2O	hydrogen,oxygen
Salt	NaCl	sodium, chlorine
Sugar	$C_6H_{12}O$	carbon, hydrogen, oxygen

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How Sweet It Was!

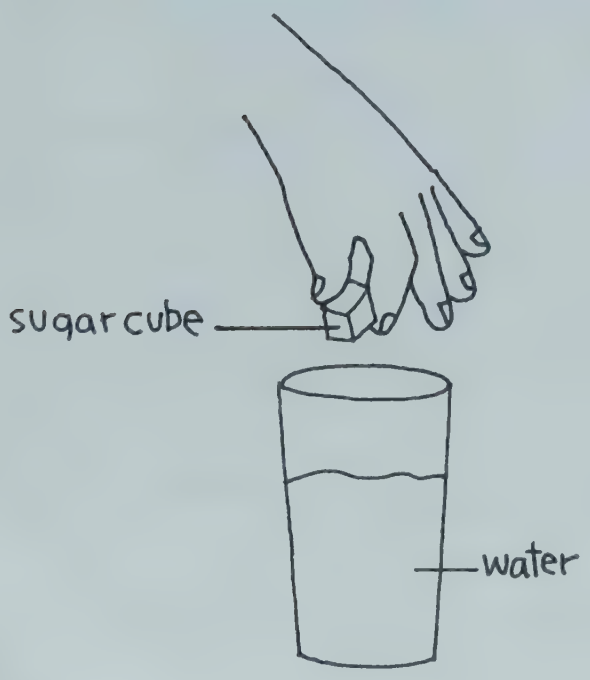
Concept: Each kind of matter is made up of its own kind of molecules, which are small, rapidly moving particles that attract each other. Molecules can be changed by heat.

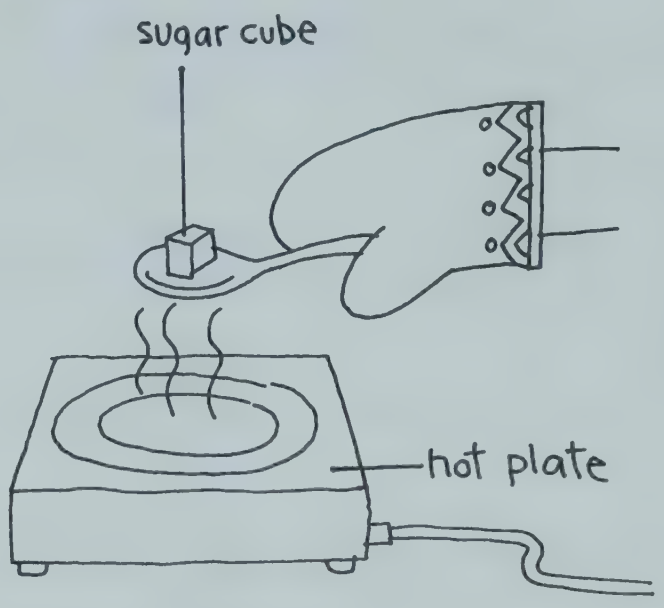
Materials: *For each group:* several cubes of sugar, glass of drinking water, metal spoon, pot holder, heat source such as a hot plate.

Plan: A sugar molecule is made up of carbon, hydrogen, and oxygen. Have students inspect a sugar cube and break it apart. Tell them that the small pieces of sugar are still made up of sugar molecules.

Have students put a sugar cube in a small glass of drinking water. Have a volunteer test the water to be sure it is sweet, indicating the presence of sugar molecules. Explain that neither the physical breaking apart of a sugar cube nor the placing of it in water changes the sugar molecules.

Next, have a student put pieces of a sugar cube on a metal spoon and carefully use a pot holder to hold the spoon over a heat source. Have students observe what happens to the sugar. After the blackened substance cools, have a volunteer taste it to ascertain that the substance is no longer sweet. You may wish to explain that the heat has changed the sugar molecule into carbon (the black substance) and water vapor, H_2O, which has dispersed into the air.





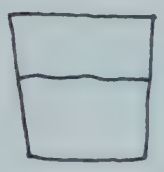
Do You Know the Solution—or Are You in Suspense?

Concept: The particles of matter in a solid-liquid solution are spread evenly throughout the solution and are invisible. The particles of matter in a suspension are visible and may settle out.

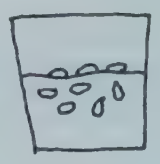
Materials: *For each group:* heatproof clear containers or beakers, water, sugar cubes, table salt, chalk, bouillon cube or powder, instant coffee, cooking oil, heat source such as a hot plate.

Plan: Tell students that they will make some mixtures and identify them as solutions or suspensions by their characteristics. They will also see how heat, particle size, and the ratio of *solute* (material present in smaller amount) to *solvent* (material present in greater amount) affects the making of solutions and suspensions.

Have students make mixtures in which they combine water with sugar cubes (whole and broken), with salt, with chalk, with bouillon cubes or powder, with instant coffee, and with cooking oil. Have students vary the amounts of solute and solvent, break cubes into smaller pieces, and heat mixtures carefully to see how these factors affect the mixtures. Have students identify each mixture as a solution or suspension.

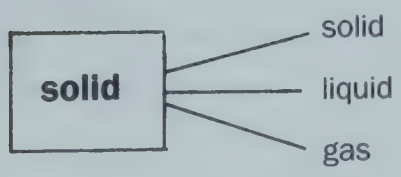


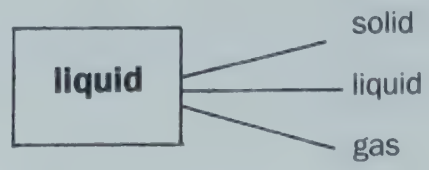
sugar and water solution; particles invisible



oil and water suspension; particles visible

Additional Activity: Have students look at home and in stores for solutions and suspensions and prepare a class list. Inform students that stainless steel is a solid-solid solution, air is a gas-gas solution, and alcohol and water is a liquid-liquid solution. Have students try to determine whether the substances in a solution or suspension are solids, liquids, or gases.





Have them try to find examples of each.

Making Vibrations

Concept: Sounds are made by vibrations that travel in waves through gas, liquid, or solid.

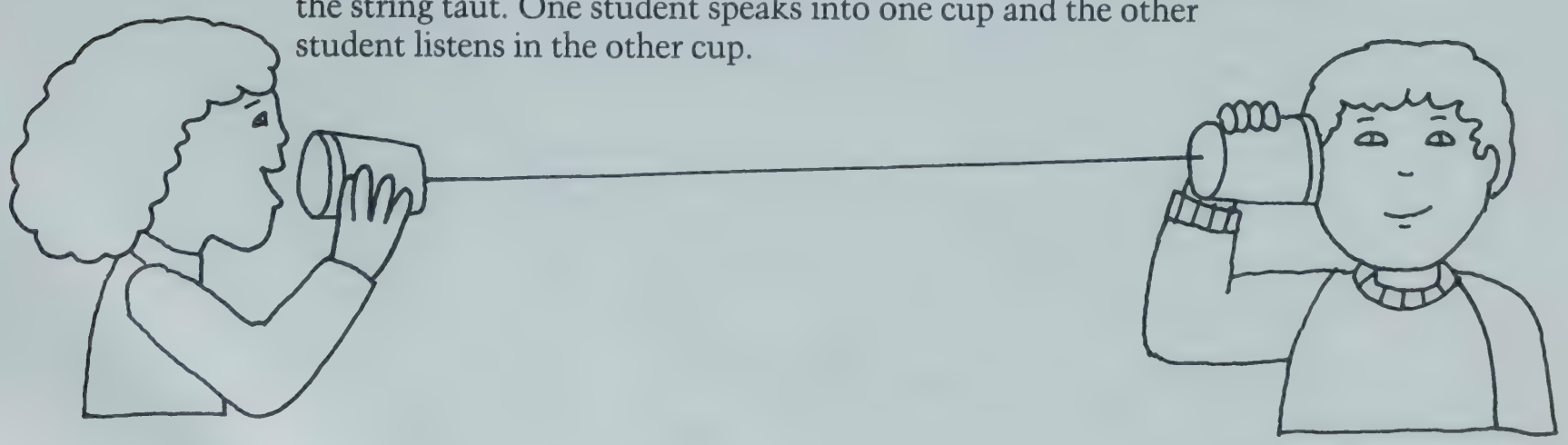
Materials: Tuning fork, elastic band, thin glass, metal fork, drum and drumstick; *for each pair:* two paper cups, string, two washers.

Plan: Have students make sounds by vibrating the tuning fork, plucking the elastic band, touching the edge of the glass carefully with the metal fork, and tapping the drum membrane with the drumstick. Have them feel the vibration while the sound is being produced, and then, after the sound has ceased, have them notice the lack of vibration.

tuning fork **elastic band** **glass** **drum**

Next have students try speaking, yelling, and singing while placing their fingers on their throats to feel vibrations. Explain that all the sounds they made have traveled through a gas, air.

Finally, have students construct a special telephone to show how sound travels through a solid, string. To make this telephone, pairs of students should punch a small hole in the center of the bottom of each paper cup, insert the ends of the string, tie the ends of the string to the washers, and move far enough apart from each other to pull the string taut. One student speaks into one cup and the other student listens in the other cup.



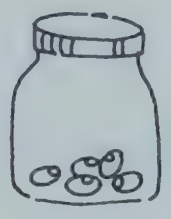
Additional Activity: Have students devise tests to see if sound waves or vibrations travel through water.

Now You Hear It, Now You Don't

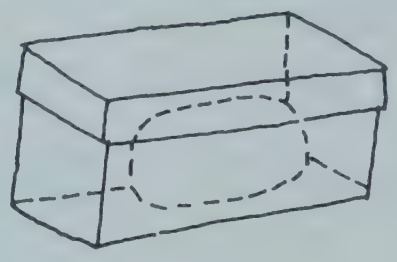
Concept: Certain soft or air-filled materials absorb sound. These materials can be used to soundproof areas.

Materials: *For each student:* empty cardboard shoe box with cover; dried peas or beans; small jar with cover; a variety of materials, such as Styrofoam peanuts, shredded newspaper, carpet scraps, tissue paper, old cloth or clothing, cotton.

Plan: Soundproofing material absorbs sound. Have students put several dried peas or beans in a small jar, close the jar, and shake it. Ask them to describe the sound they hear. Next have students fill their shoe boxes with each of the different sound-absorbing materials; place their jars inside the boxes, taking care to wrap the sound-absorbing material around the jars; close the shoe boxes, and shake them.



jar with dried beans



jar wrapped in old cloths in shoe box

Have students describe the sounds they hear when the jar is wrapped in different materials. Have students make a chart such as the one below on which to list the materials and the loudness of the sounds they hear. Have students decide which material they think absorbs sounds best.

MATERIAL	SOUND
1. Styrofoam peanuts	**1. muffled**
2. newspaper	

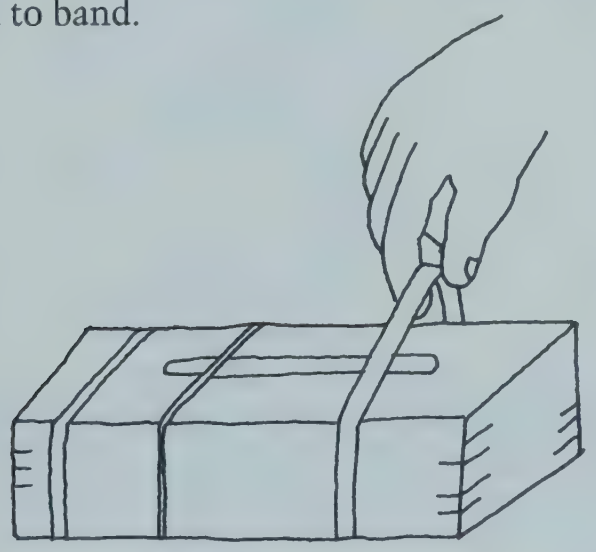
What's the Pitch?

Concept: Sounds differ in both pitch and loudness. Pitch depends on the frequency of sound waves.

Materials: *For each group:* tissue box with opening, several rubber bands of different widths.

Plan: The pitch, or number of vibrations, of rubber bands of different widths will differ. Wider bands vibrate less frequently and have lower pitches than narrower bands.

Have students wrap several rubber bands around the tissue box and pluck each band. Have students describe how the sound varies from band to band.



Next, have students stretch each rubber band and pluck it while it remains stretched. Have students describe how the pitch varies when the band is stretched.

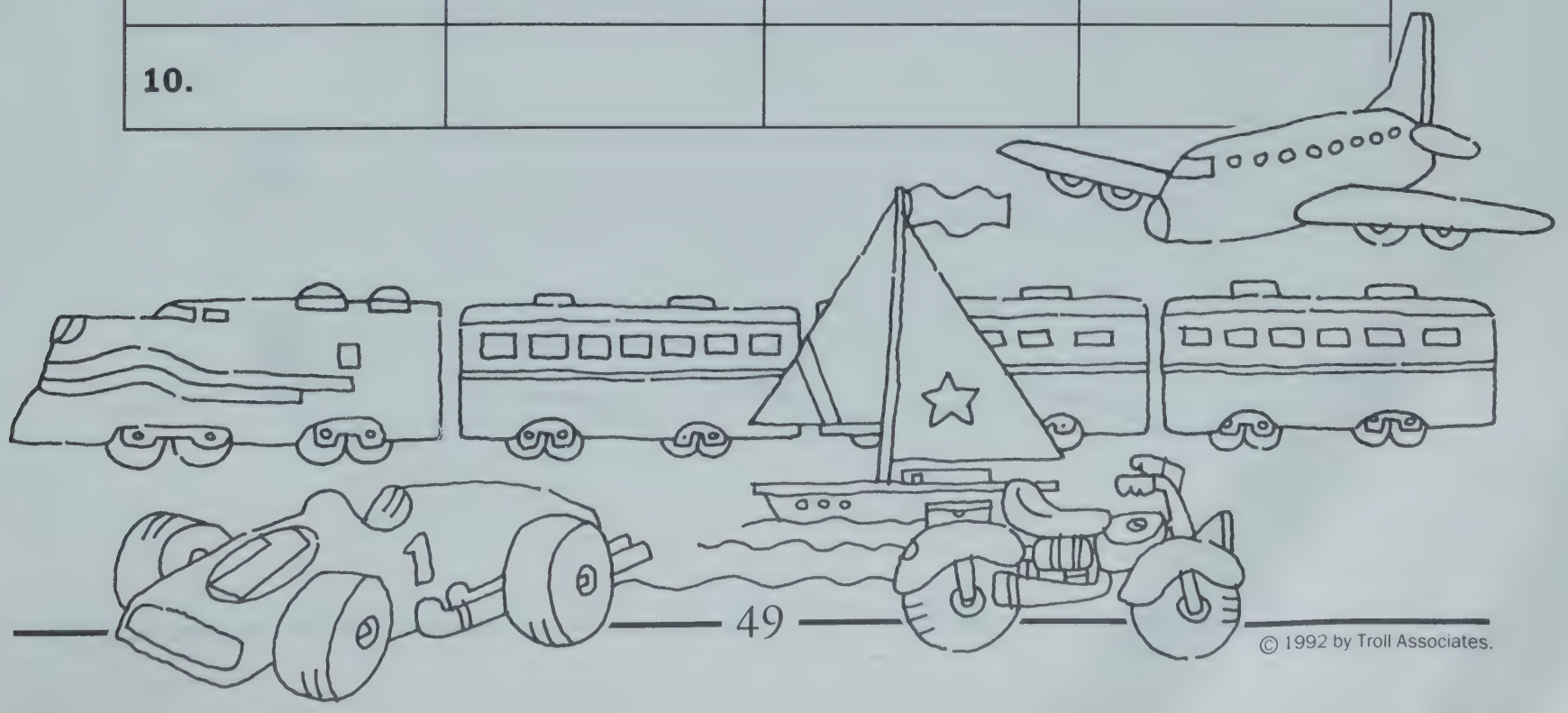
Additional Activity: Have students observe the strings on a violin or guitar and predict which strings will have the highest and lowest pitches. Let students pluck the strings to check their predictions.

Name _____ Date _____

The Notion of Motion

Motion is a change from one position to another. Motion is described in terms of distance, direction, and speed. Describe some objects in motion around you. Try to describe distance, direction, and speed.

Object	Distance	Direction	Speed
1. hand	5 inches (12½ cm)	up	5 inches (12½ cm)/second
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			



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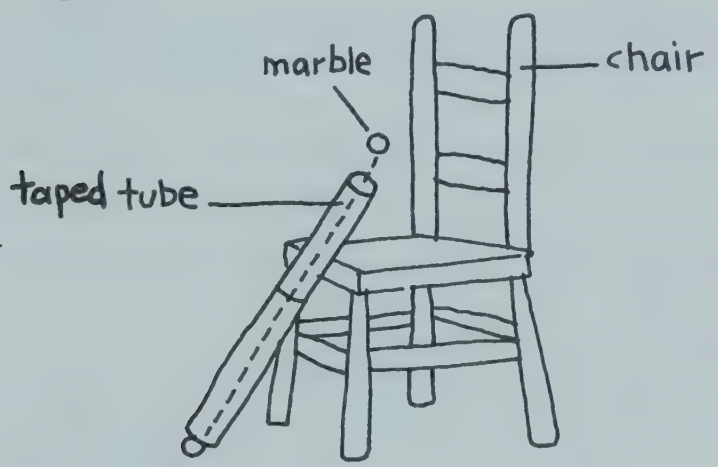
It Just Keeps Rollin' Along

Concept: The speed of a moving object can be found by dividing the distance it travels by the time it takes to do so.

Materials: *For each pair:* several paper-towel tubes; tape; meter- or yardstick; chair; marbles; timer, clock, or watch with second hand.

Plan: Tell students that they will make several trials to find the average speed for a marble traveling a certain distance. Have students tape paper-towel tubes together to reach from a chair seat to the floor. Have them measure and record the length of the tube. Next have one student drop the marble into the tube while the partner times and records the number of seconds from marble drop to marble impact.



Have pairs of students do trials and record the results of each in a chart like the one below. They can find the rate of speed (*r*) by dividing the distance (*d*) by the time (*t*). For an overall average students can divide the total distance by the total time.

Trial	Tube length (*d*)	Time/sec (*t*)	Speed (*r*)
1			
2			

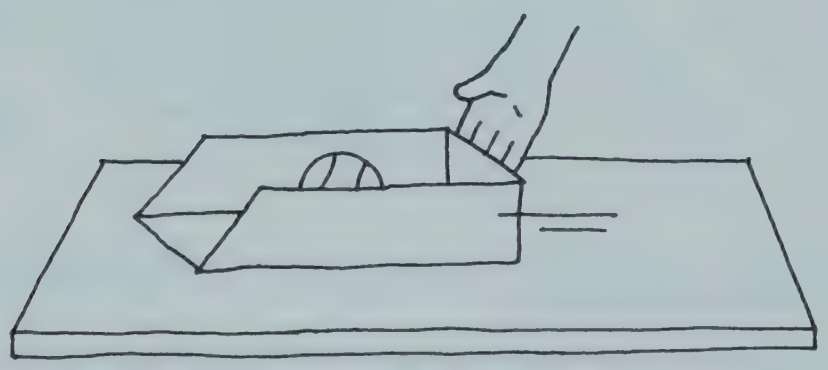
Something's Got to Give

Concept: Isaac Newton developed the three laws of motion that explain how all things move.

Law 1: Objects in motion stay in motion; objects at rest stay at rest unless a force acts on them.
Law 2: An object's acceleration depends on its mass and on the size and the direction of the force acting on it.
Law 3: For every force there is an equal, opposite force.

Materials: *For each group:* rubber ball or tennis ball, shoe box, scissors.

Plan: Tell students that they can demonstrate Newton's first law of motion. Have students carefully cut the edges of the shoe box so that it resembles a scoop and then place the ball inside the carton. Have them quickly slide the box along a flat desk or tabletop with the open side facing forward.



As the box approaches the desk edge, they should stop the box abruptly and record what happens to the ball. Students should note that even though the box was stopped, no force was applied to the ball. As a result, the ball kept moving.

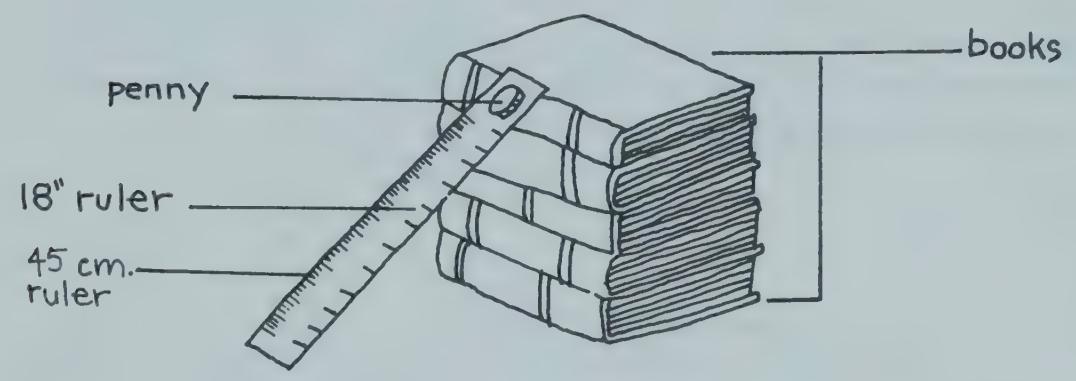
Additional Activity: Have students devise experiments to show the second and third laws of motion.

The Forces Be with You—Friction and Gravity

Concept: Friction is a force that opposes motion between objects in contact. Gravity is a force that pulls objects together. Life on earth is greatly affected by both friction and gravity.

Materials: *For each group:* wooden ruler; stack of books; variety of small objects, such as pennies, paper clips, erasers, pen caps, and so on.

Plan: All objects on earth are affected by both friction and gravity. Students will make an inclined plane using a wooden ruler and a stack of books to find out when gravitational force will overcome frictional force, causing an object to slide down the incline. Students who are mathematically oriented may wish to find the slope for each object. To do so they should measure the height of the inclined plane.



Slope is equal to height divided by base. Heavier objects will slide at lesser slopes than lighter ones.

Have students record the height at which different objects slide down the ruler in a chart like this one:

Object	Height at which slide began
1. penny	
2.	

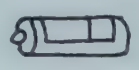
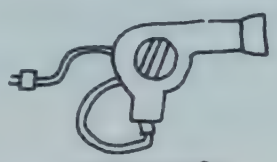
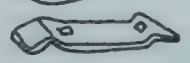
Name _____ Date _____

Identifying the Work Force

Work is done when a force moves an object. Some energy sources that allow machines to do work include the following:

- light
- heat
- electrical
- chemical
- mechanical
- sound

Identify which energy source allows each machine listed to do its work.

Machine	Energy Source
1. battery 	
2. hair dryer 	
3. bottle opener 	
4. charcoal grill	
5. solar heater	

List some other machines and identify their energy sources.

Machine	Energy Source
6.	
7.	
8.	
9.	
10.	

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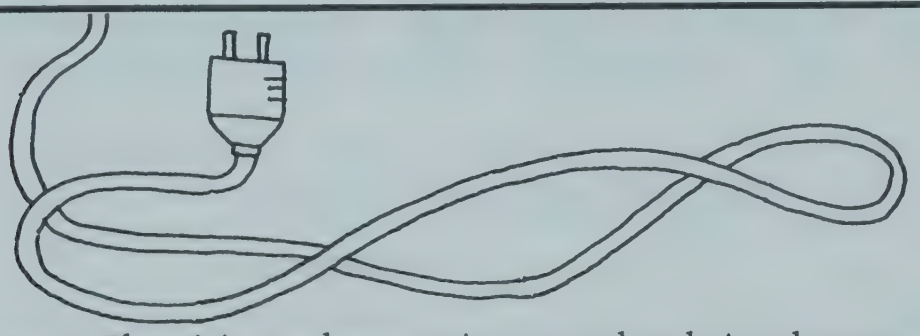
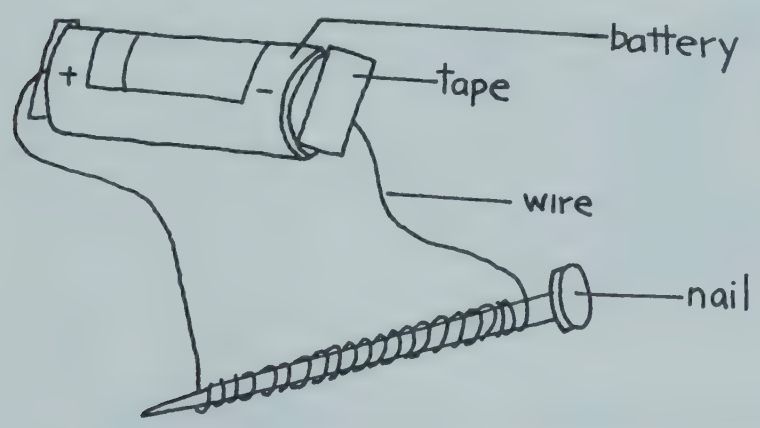
It's an Attractive Wrap!



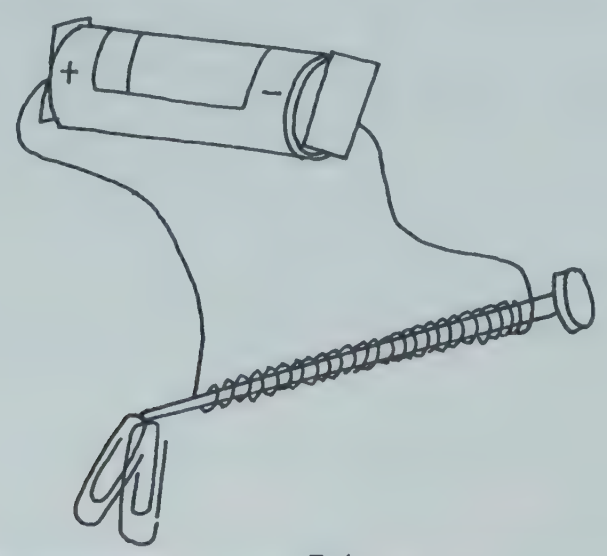
Concept: Electricity and magnetism are related. An electromagnet can be made by wrapping wire into a coil and passing an electric current through it.

Materials: *For each group:* size D battery, 1 yard/meter bell wire, scissors, large iron nail, box of paper clips.

Plan: Students will make and use an electromagnet. First have them remove the coating from both ends of the bell wire and wrap the middle of the wire in a coil around the iron nail. There should be about twenty-five loops or turns. Next they should connect the ends of the wire to both ends of the battery as shown.



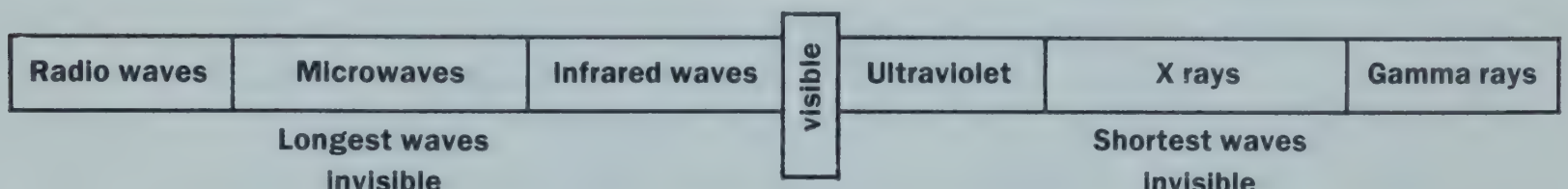
Have students try picking up paper clips using their electromagnets. Some students may wish to make electromagnets of different strengths by using more loops or additional batteries. Have students predict how their electromagnets will be affected by more batteries or loops and then have them check their predictions by picking up paper clips.



Name _____ Date _____

Making Light of It

Radiant energy from the sun is transmitted to earth by electromagnetic waves of different lengths and frequencies. Most of these waves are invisible. The waves make an electromagnetic spectrum.



Research the uses and/or dangers of each type of ray. Use the chart below to record your findings.

Radio waves
Microwaves
Infrared waves
Ultraviolet
X rays
Gamma rays

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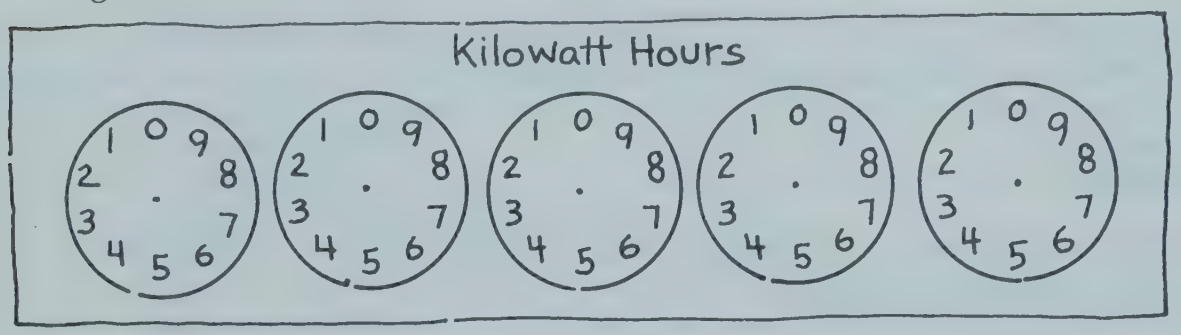
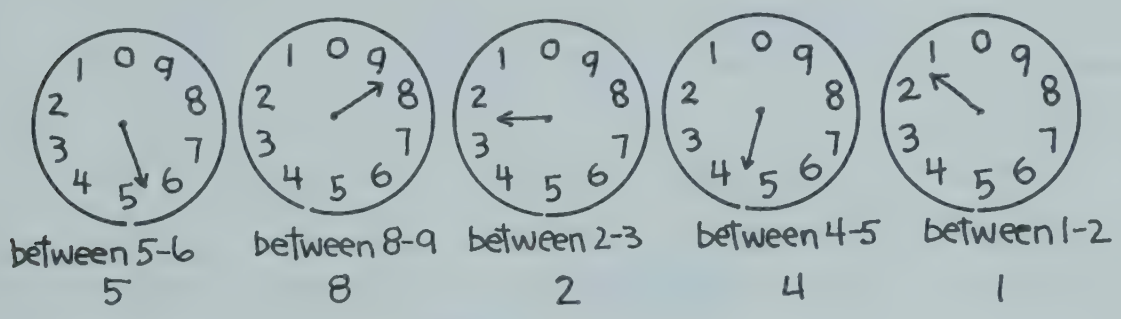
Be a Better Meter Reader

Concept: Electric meters measure electric energy used. The electric power company uses these readings to compute electric bills. Electric energy used is measured in kilowatt hours (kwh).

Materials: *For each group:* several index cards with the following diagram drawn on them.

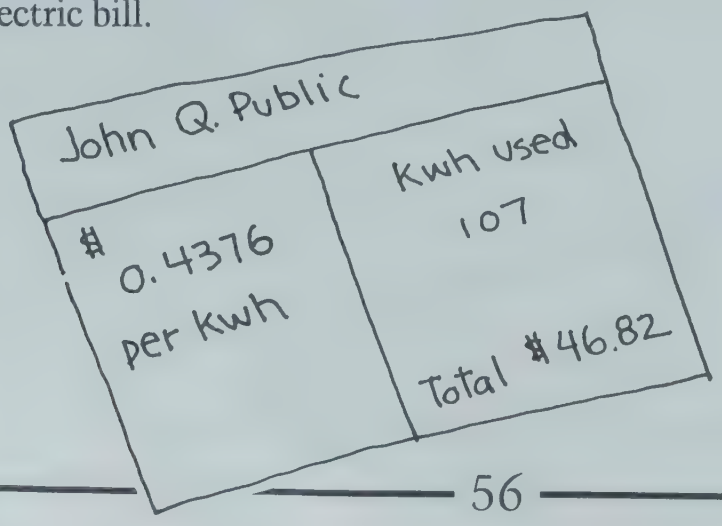


Plan: Tell students that they are going to learn to read electric meters so that they can check the readings in their homes. You may wish to copy this example of a meter reading on the chalkboard and explain to students how it is read.



The reading is 58,241 kwh.

Have students use the index cards and draw the hand of the meter as in the example. Explain to students that to find the electricity consumed they must make two readings and subtract the first from the second. Usually the power company makes readings every month or two months, so students may wish to follow the same schedule. To find the cost of the electricity consumed, students must multiply the number of kilowatt hours by the rate per kilowatt hour. Tell students that they can find the rate per kilowatt hour on their family's electric bill.



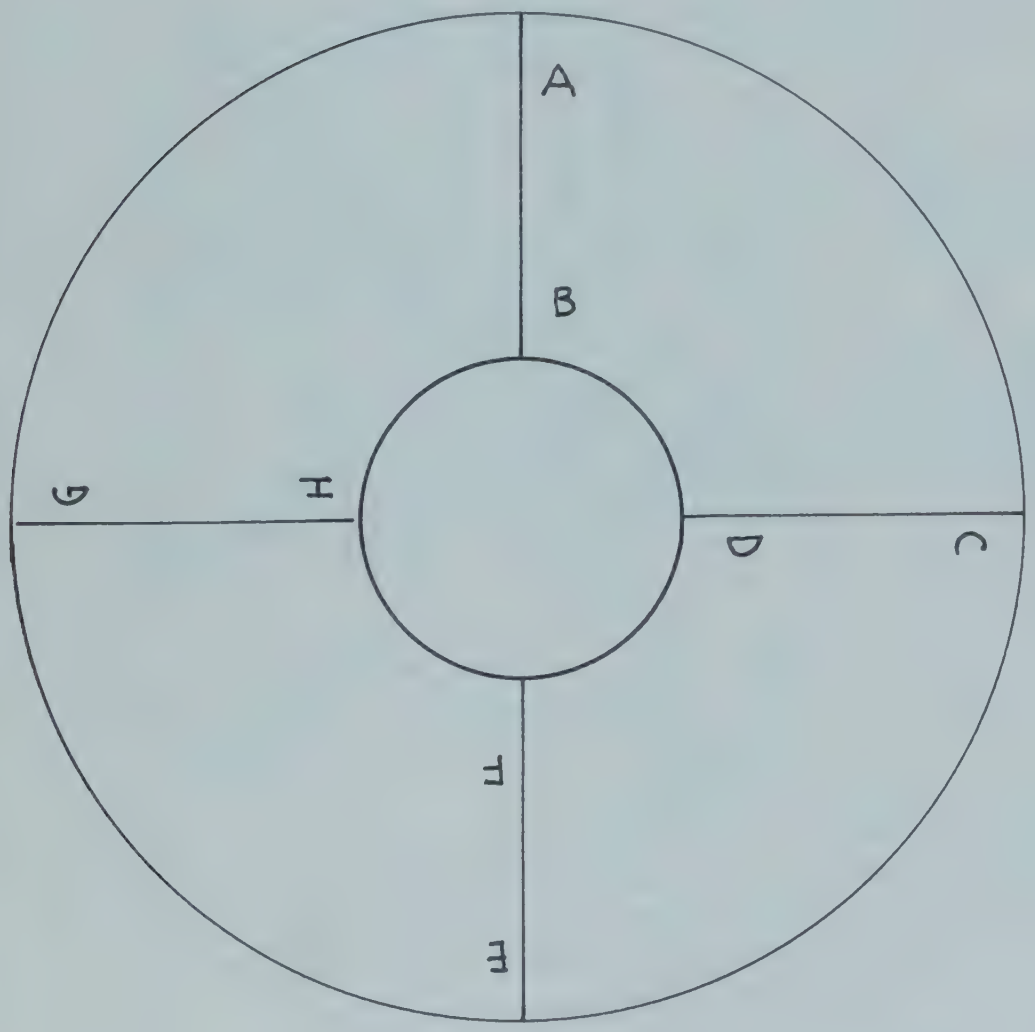
Going Around in Powerful Circles

Concept: Energy sources such as wind or water turn the blades of windmills and turbines.

Materials: Safety compasses, sheet of heavy aluminum foil, pencil with eraser, scissors, straight pin, glass of water, plastic dishpan or bucket.

Plan: Explain to students that wind or water can supply the power needed to turn the blades of windmills and turbines. A simple pinwheel can demonstrate how this works.

On a sheet of foil, have students use their safety compasses and pencils to re-create the circle pattern shown.



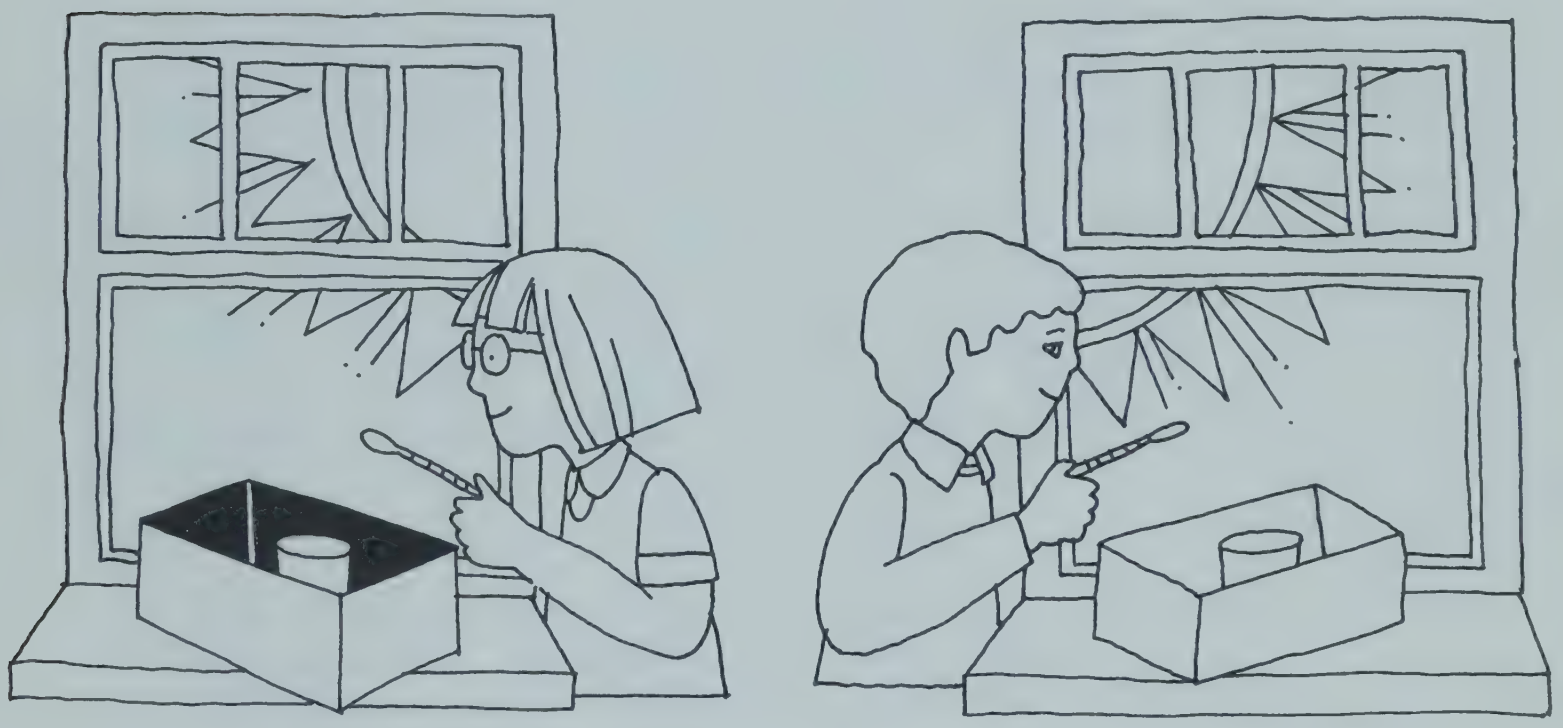
Have them cut out the outer circle and then make four cuts along the lines labeled AB, CD, EF, and GH. Next, tell them to fold corners A, C, E, and G to the center until they overlap. Then have students fasten the overlapped corners to the center and to the eraser end of a pencil with a straight pin.

Catch a Sunbeam!

Concept: Solar collectors collect solar energy and convert it into heat. Some homes use solar collectors to supply heat and hot water. Solar energy is abundant, requires no fuel, and does not pollute.

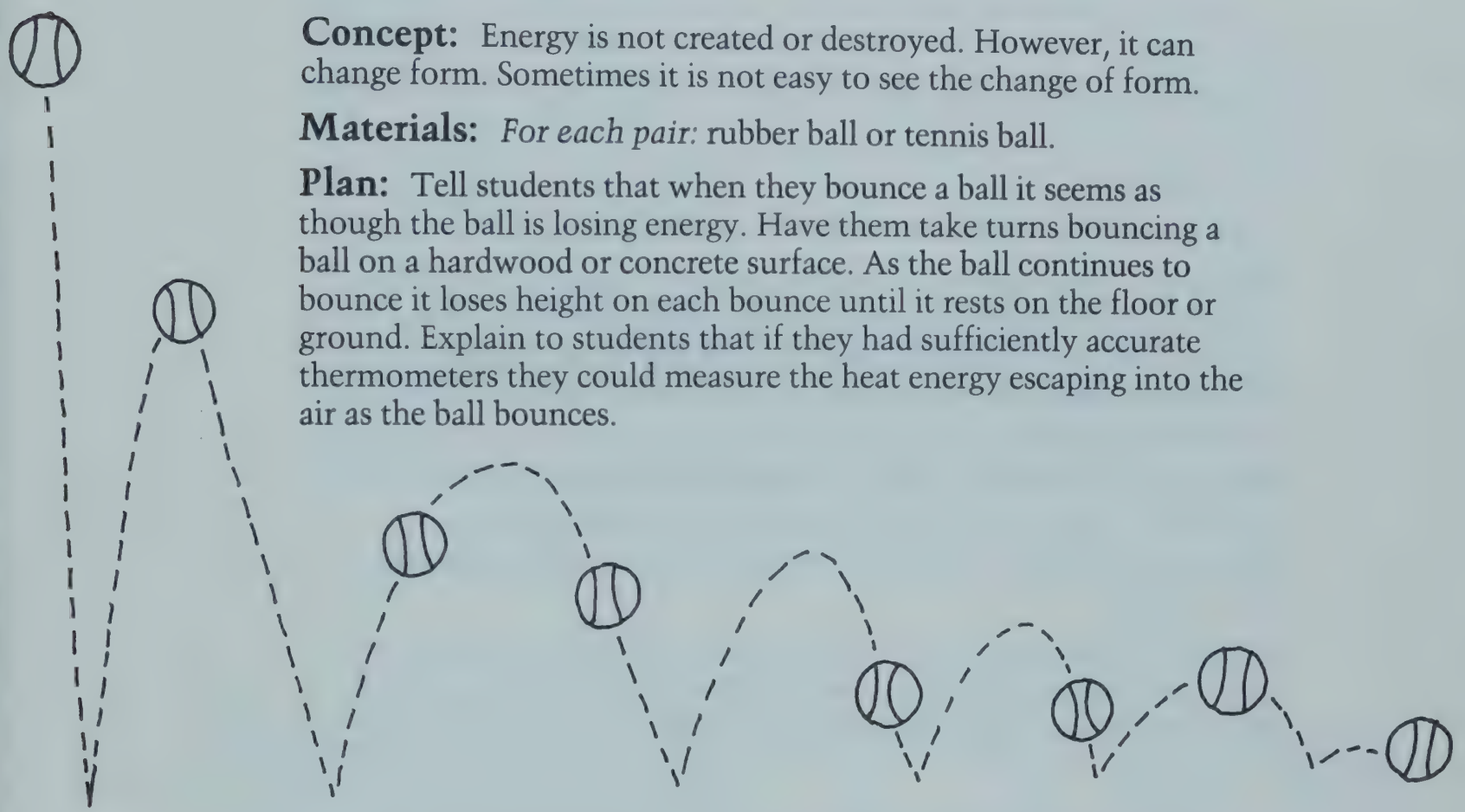
Materials: *For each group:* two shoe boxes, 1 sheet of black construction paper, 1 sheet of white construction paper, 2 clear plastic cups, water, thermometer, clear plastic wrap, tape.

Plan: Tell students that they are going to make two solar collectors, decide which one is more efficient, and tell why. Have students line one shoe box with the black paper and the other with the white paper. They should set the shoe boxes in the sunlight on a windowsill and place a plastic cup of water in each.



Have students record the temperature of the water in each cup (it should be the same). Next they should wrap and tape both of the cups and then the shoe boxes in clear plastic wrap. Have students measure and record the temperatures for each cup after 1, 2, and 3 hours, carefully wrapping and taping the cups and boxes after each temperature taking. Ask students in which box the temperature rose more quickly. Some students may comment on the fact that the panels in solar collectors are usually black.

That's the Way the Ball Bounces



Concept: Energy is not created or destroyed. However, it can change form. Sometimes it is not easy to see the change of form.

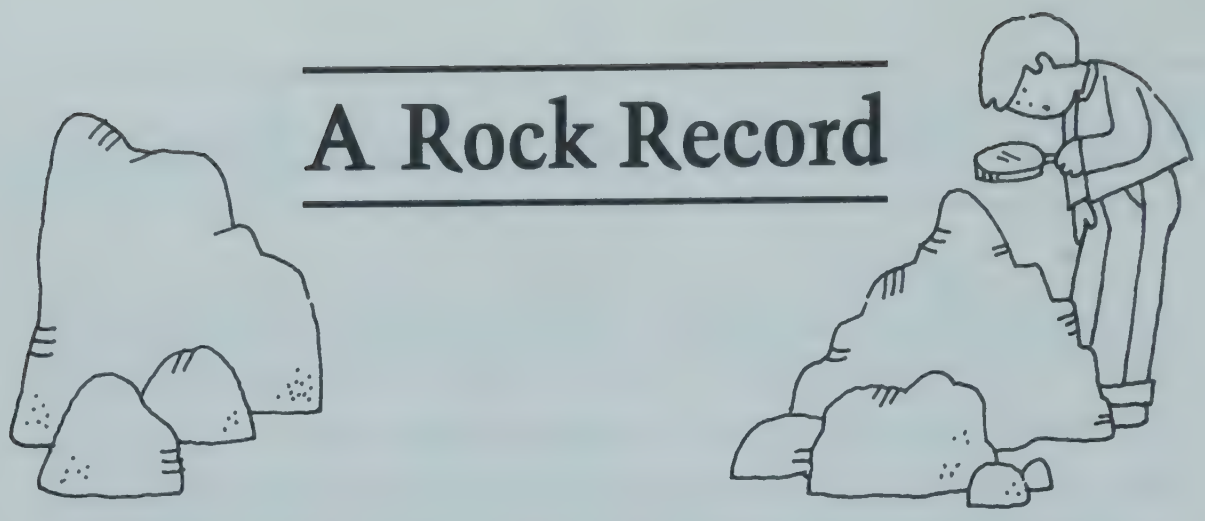
Materials: *For each pair:* rubber ball or tennis ball.

Plan: Tell students that when they bounce a ball it seems as though the ball is losing energy. Have them take turns bouncing a ball on a hardwood or concrete surface. As the ball continues to bounce it loses height on each bounce until it rests on the floor or ground. Explain to students that if they had sufficiently accurate thermometers they could measure the heat energy escaping into the air as the ball bounces.

Then, on a chart like the one below, have students make a list of energy changes that they can see, such as electrical energy becoming light when they turn on a desk lamp. Have them indicate the type of energy before and after the change.

Action	Original energy form	Changed energy form(s)
Turn on stove.	electricity, gas	heat

A Rock Record



Concept: Rocks can be classified as igneous (formed from melted material), sedimentary (formed by layers of sediment), or metamorphic (formed underground under heat and pressure). All rocks can change from class to class. Sedimentary rocks contain clues to the earth's history.

Materials: *For each group:* samples of different kinds of sedimentary rocks, such as conglomerate, dolomite, gypsum, limestone, and shale. You may obtain these rocks from a science supply house.

Plan: Tell students that they will examine different kinds of sedimentary rocks. Have them make a chart, such as the one that follows, to record similarities and differences.

Rock	Texture	Weight	Color	Size of particles
1. gypsum 2. dolomite 3.				

Explain that some rocks contain fossilized plants or animals and that the position of these fossil remains in layers of rock can tell scientists much about the history of the earth. Each layer of rock can represent a period of history.

Additional Activity: Have students write a "rock song" or poem that deals with layers of rock and the earth's history. One such song or poem might begin with "When I was just a little pebble, in the age of dinosaurs...."

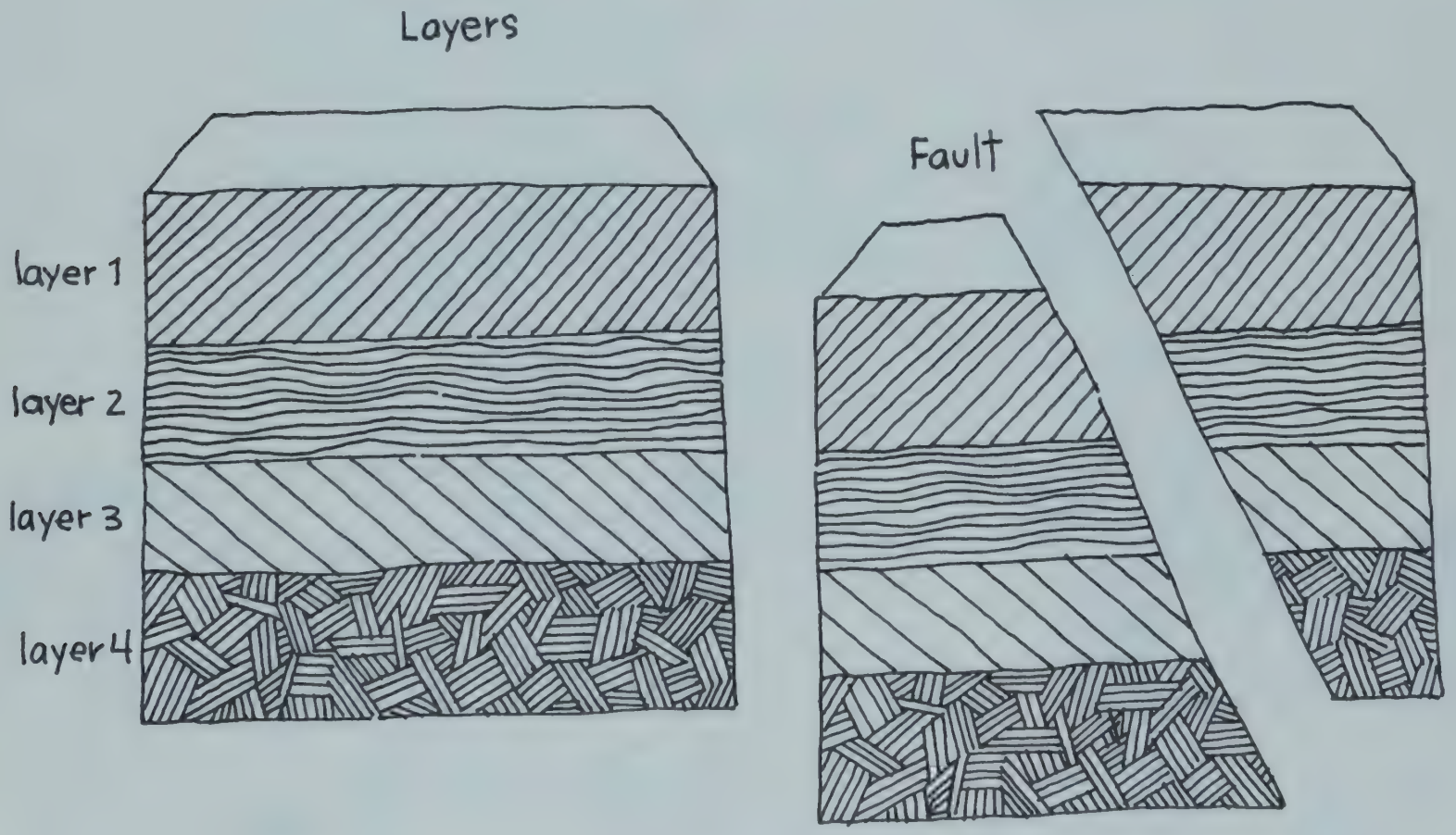
Earthquakes—Whose Fault?

Concept: Earthquakes are the result of pressure. Faults (breaks or cracks) in rock layers and slippage of rocks may start earthquakes.

Materials: *For each group:* four different colors of modeling clay, knife or cheese cutter.

Plan: To show what a fault is, have students layer four different colors of modeling clay. Then have them carefully cut the clay layers at an angle.

Next, have students move one part of the clay about two levels lower than the other, creating a model of a fault. Explain that high earthquake activity occurs where faults exist. Some students may have experienced earthquakes along the San Andreas Fault or in other places. If so, have them describe what happened.



Additional Activity: Have students research the Richter scale, which measures the amount of energy released in an earthquake, or the Mercalli scale, which describes the amount of damage done by an earthquake. Call on volunteers to report their findings to the class.

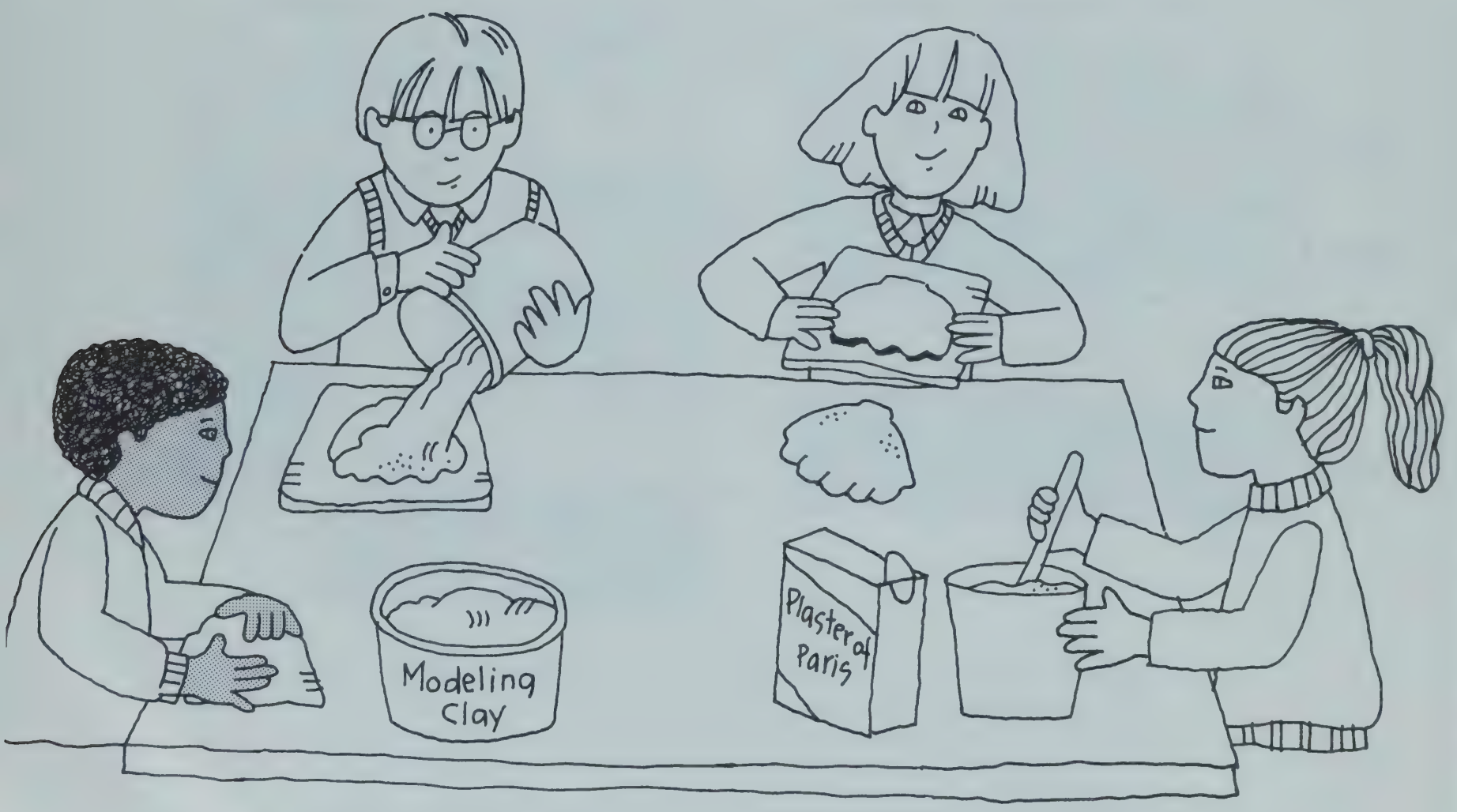
It's Cast or Molded in Stone

Concept: Fossils are the remains or the prints of plants or animals that are preserved in layers of rock, usually in layers of sedimentary rock. Mold fossils are hollow spaces left in the shape of the organism. Cast fossils are made by minerals or remains of an organism and look more like the organism itself.

Materials: *For each group:* modeling clay, plaster of Paris, water.

Plan: Explain that students will make models of both cast and mold fossils. First have them use modeling clay to make a mold. Some objects students might make molds of include bones, shells, leaves, and small plants such as daisies.

To make a model of cast fossils, have students mix and pour the plaster of Paris into their mold. After the plaster sets, students will have a cast fossil model.



Additional Activity: Have students research trace fossils and tell how they differ from mold or cast fossils.

Once upon a Time

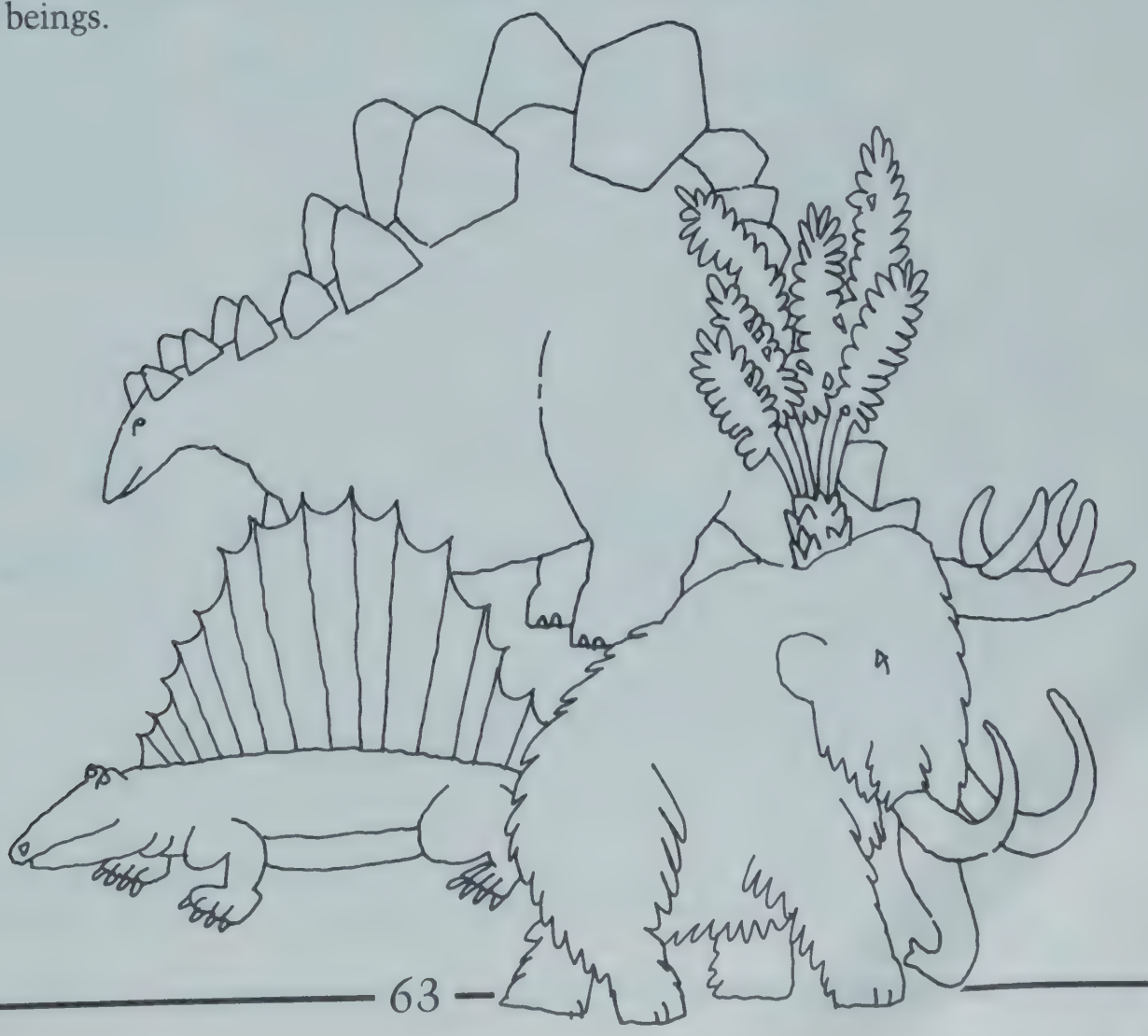
Concept: The four eras of the earth's history are the Cenozoic, Mesozoic, Paleozoic, and Precambrian. These ages stretch from the present to over 4,000,000,000 years ago. Human beings are relative newcomers to the earth.

Materials: *For each group:* long strip of adding machine tape, pencils, metric measuring tape.

Plan: Tell students that the Cenozoic age goes back about 70 million years, the Mesozoic goes back about 225 million years, the Paleozoic goes back about 550 million years, and the Precambrian stretches back about 4.5 billion years. Let students decide on a scale such as 1 cm = 10 million years and use the tape to model the eras. Ask which age was the longest (Precambrian). The length of the tape for each age should be:

- Cenozoic—about 7 cm
- Mesozoic—about 22.5 cm
- Paleozoic—about 55.5 cm
- Precambrian—about 450 cm or 4.5 m

Additional Activity: Have students research the kinds of life that existed in each age and mark significant events on their tapes. Some possibilities include first life, dinosaurs, mammals, human beings.



How Salty Is the Ocean?

Concept: Salinity, the measure of an ocean's salt, varies. As ocean water evaporates the remaining water becomes saltier.

Materials: *For each group:* glass liter or quart container, 1 teaspoon (4 ml) table salt, glass jar with lid, shallow pan or dish.

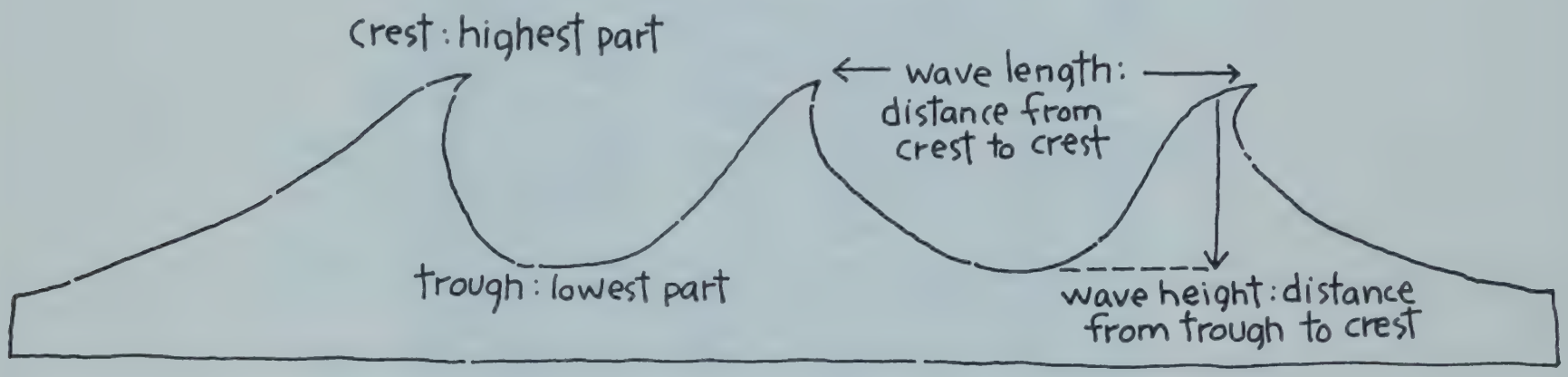
Plan: Tell students that they will show that as salt water evaporates the remaining water becomes saltier. Have students make a solution of salt water by mixing together the salt and water. Then have them pour half the solution into the glass jar and cover it. Next they should pour the remaining solution into the shallow dish and place both containers on a sunny windowsill. After several days, have students test to see which solution is saltier and explain why. Have students predict where oceans might be the least salty. (Usually near river entrances where fresh water dilutes the salinity.)

Making Waves

Concept: Wind blowing over water creates waves. All waves have a crest and a trough, and are measured by height and length.

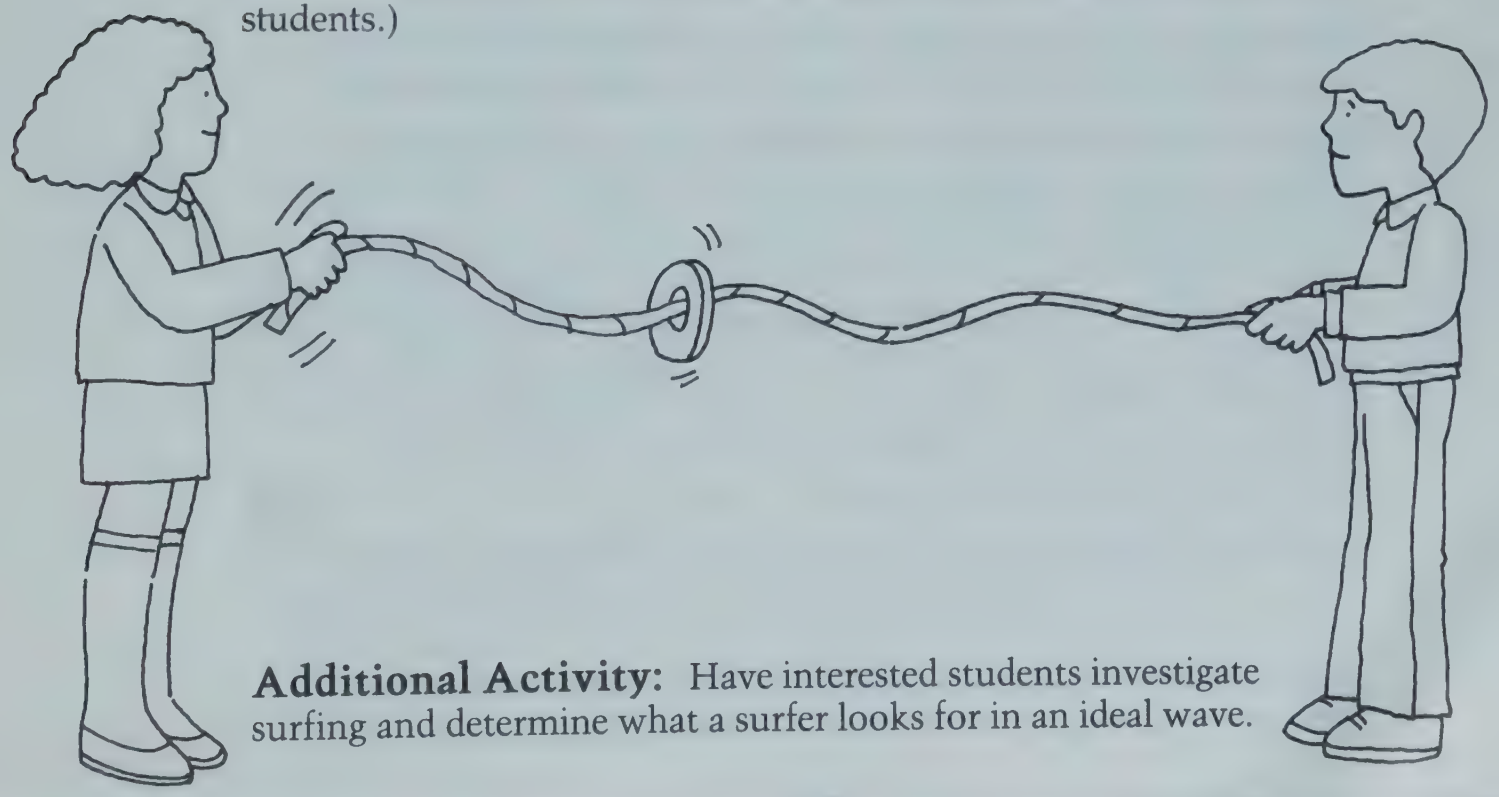
Materials: *For each pair:* length of rope about 17 feet (5 m) long, strip of oaktag about 1 inch (2 1/2 cm) wide, and strip of tape about 3 inches (8 cm).

Plan: Tell students that they are going to simulate a wave and identify its four parts.


crest : highest part
wave length: distance from crest to crest
trough : lowest part
wave height : distance from trough to crest

Have students make a ring using the oaktag strip. Then have them put the rope through the ring. The ring should be positioned at the center of the rope. Have both students hold an end of the rope.

Tell one student to begin "making waves" by moving one end of the rope up and down. Have students identify the four parts of the "wave" and try to determine how many "waves" will send the ring to the end of the rope. (The paper ring will not reach the end of the rope as long as one end is moved and the rope is held level by two students.)



Additional Activity: Have interested students investigate surfing and determine what a surfer looks for in an ideal wave.

Current Events

Concept: Ocean currents are huge rivers of moving water either on the surface of or deep in the water. Currents are caused by winds and temperature differences and are affected by tides, the earth's rotation, and the land masses or continents.

Materials: *For each group:* plastic cup, three or four ice cubes, blue food coloring, stirrer, jar, warm water, cold water, dropper.

Plan: Tell students that they will use warm and cold water to simulate a current formed by temperature differences. Have students fill the plastic cup halfway with cold water, add the ice cubes and several drops of blue food coloring, and stir the solution. Tell them to add enough coloring to make the water appear blue. Next, have students fill the jar about 3/4 full with warm water. Tell them to use a dropper carefully to add eight to ten drops of the cold blue mixture to the jar. Have students observe the movement of the "cold currents" to the bottom of the jar.

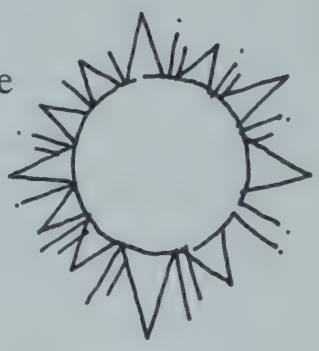
Additional Activity: To observe the movement of "warm currents," have students repeat the activity using warm water in the cup and cold water in the jar. Tell them to place the dropper near the bottom of the jar and then release the "blue warm current." Let them watch as this "current" makes its way to the top.

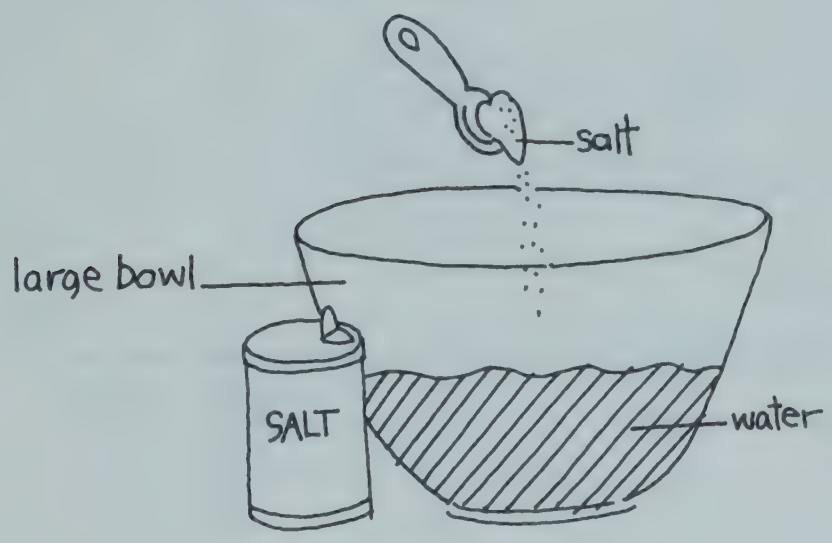
Salt of the Earth

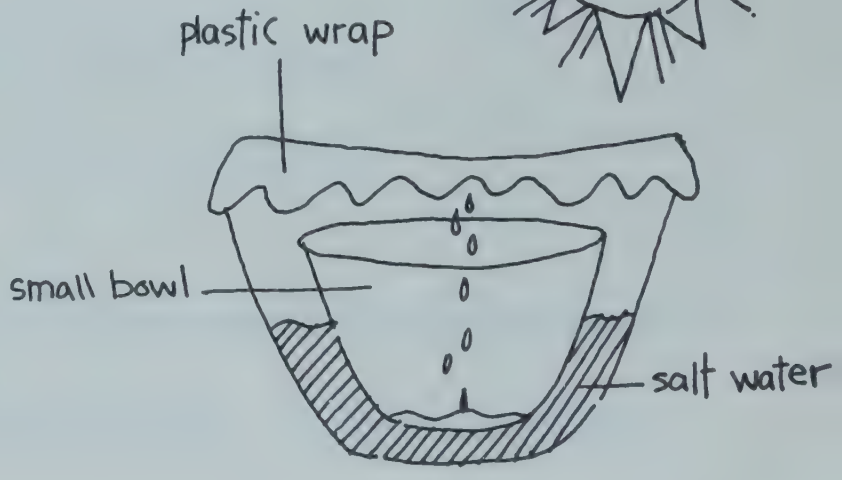
Concept: Seawater can be distilled to produce fresh water, salt, and other minerals.

Materials: *For each group:* large plastic bowl, small plastic bowl that fits inside large one, water, salt, clear plastic wrap.

Plan: Tell students that they can distill salt water to produce fresh water and minerals. Have students fill the large bowl halfway with water and mix in about 1 tablespoon (4 ml) salt. A volunteer may taste the water to verify that it is salty. Next, students should place the smaller bowl inside the larger one, loosely cover the two-bowl arrangement with clear plastic wrap so that the wrap dips a bit in the middle, and place the bowls in a warm, sunny spot.



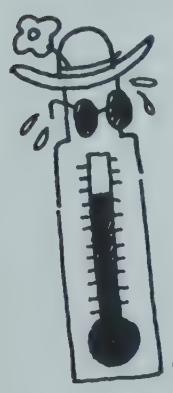




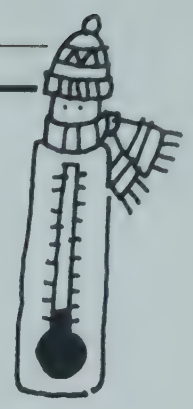
Over several days the salt water will evaporate and condense on the plastic wrap, eventually dripping fresh water into the small bowl. Have a volunteer taste the water in the small bowl to verify its freshness.

Additional Activity: Have students research how desalination is accomplished in large plants.

Name _____ Date _____



Record Temperatures



Keep a record of the morning and evening temperatures every day for a month. Record the weather conditions each day also.

From _____ To _____

S	M	T	W	T	F	S

Do you see any patterns? What are they?

_____

_____

_____

_____

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When You Are Hot, Is Everyone Hot?

Concept: Weather is the state of the atmosphere with respect to temperature, moisture, winds, and air pressure at a given time. Climate refers to these characteristics or factors over a long period of time. Climate is dependent on latitude, altitude, land and ocean masses, winds, currents, and topography.

Materials: *For each group:* almanac.

Plan: Tell students that by using data from an almanac they can predict the weather for a given month. Included among the things they can predict are:

- high temperature
- normal temperature
- low temperature
- precipitation
- wind speed
- clear and cloudy days
- temperature–humidity index

Have students write their predictions on a chart, record what actually happens for a month, and write an explanation of which figures vary and why. Ask students which figures were closest to their predictions. Then have students write a paragraph or two describing what they think hot weather, bad weather, or rainy weather is. Ask why some of their paragraphs might be subjective. Some possibilities include:

- A skier might consider a snowstorm good weather.
- A farmer in a dry spell might consider a rainstorm excellent weather.
- A person required to mow a lawn might consider a sunny day bad weather.

April

	Prediction	Actual
high temperature		
normal temperature		
low temperature		
precipitation		
wind speed		
clear and cloudy days		
temperature-humidity index		

Name _____ Date _____

Do You Know Weather . . . ?

List all the causes of weather you can think of and describe their effects. Use a newspaper weather report for ideas if you wish. Then describe your ideal weather.

CAUSE	EFFECT
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

My Ideal Weather

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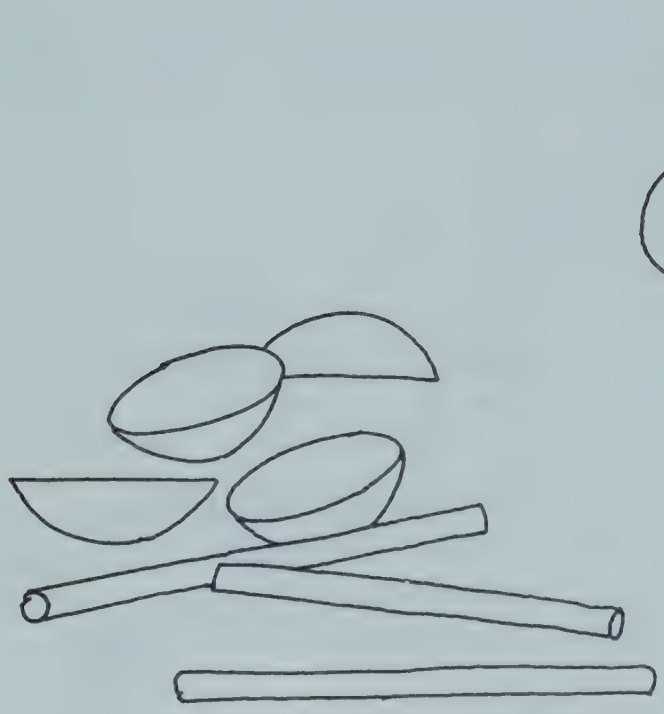
"Who Has Seen the Wind?"

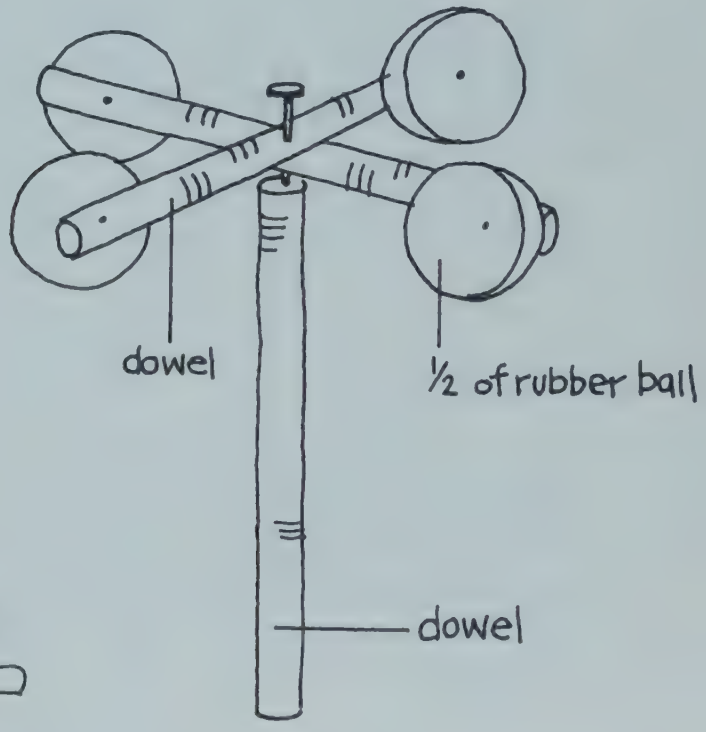
Concept: Wind is defined as the horizontal movement of air. In order to forecast weather it is important to know both the speed and direction of the wind. An anemometer measures wind speed.

Materials: *For each group:* two hollow rubber balls of different colors, three wood dowels, one long nail, four short nails, sharp knife, watch with second hand or timer.

Plan: Students will build an anemometer that will allow them to measure relative wind speeds. Under your close supervision, have students carefully cut the hollow rubber balls in half and set up the anemometer as shown in the diagram below by nailing each half ball to a dowel.

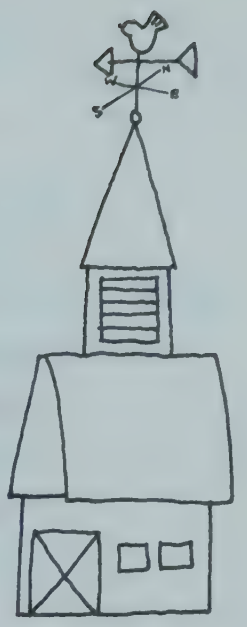
Alternate colors of the half balls. The crossed dowel arrangement should be attached to another dowel by a long nail loosely enough to allow it to turn.





Have students place their anemometers outside on a post and observe them on several days when winds seem to differ. Students should use the watch or timer to count and record the number of turns the anemometer makes per minute under different wind conditions. The higher the number of turns, the greater the wind speed.

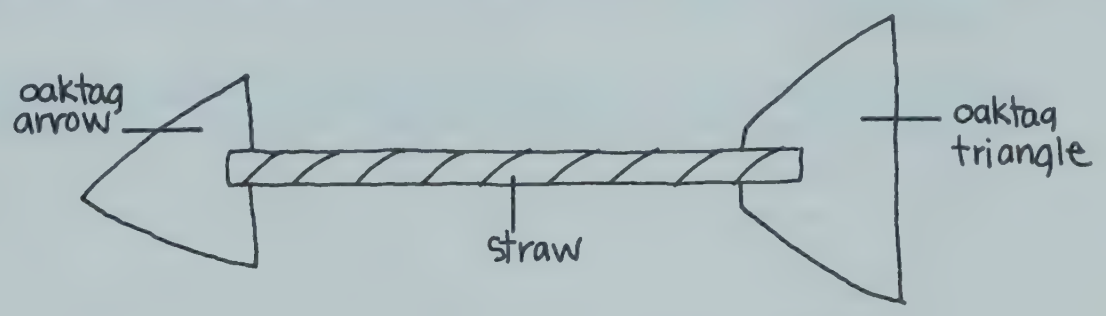
It's All in Vane



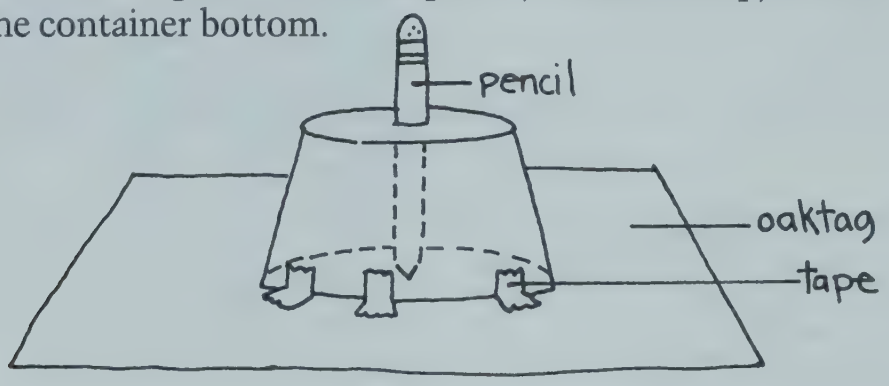
Concept: A wind vane indicates wind direction. It points in the direction that the wind is coming from. For a north wind, a wind vane points north.

Materials: Two sheets of oaktag, plastic drinking straw, scissors, pencil with eraser, thin nail or strong straight pin, strong plastic cup or cottage cheese container, masking tape, compass.

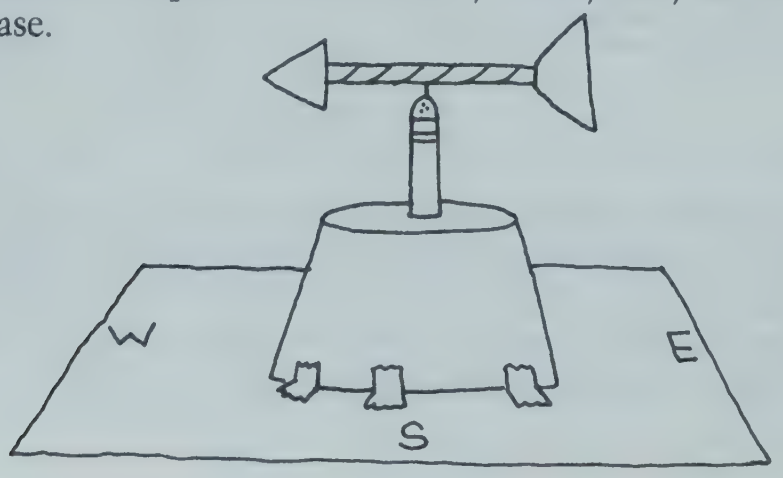
Plan: Tell students that they can make a simple wind vane to find the direction the wind blows. Have them cut a large and a small triangular shape from one piece of oaktag, slit both ends of the straw, and insert the triangles as shown.



Next, they should tape the plastic container, open side down, to the second piece of oaktag and insert the pencil, eraser side up, into the center of the container bottom.



Students should gently nail or pin the middle of the straw-and-arrow device to the eraser. They should test that the vane swings freely. After bringing their apparatus outside and positioning it, students should use the compass to label North, South, East, and West on the oaktag base.



It's All Relative

Concept: Relative humidity is the amount of water vapor in the air compared to the amount that the air can hold at a given temperature. Usually relative humidity is expressed as a percent. Relative humidity can be measured.

Materials: *For each group:* two Celsius thermometers, water, paper towel strip, thread or string.

Plan: Tell students that they will use thermometers and a table to measure relative humidity. The two thermometers should register the same temperature. First the students will dip the paper towel in water and wrap it around the bulb of one thermometer, tying it with the thread. Next they will place both thermometers in a breezy place out of the sun for about 15 minutes. Then students should record the temperature on each thermometer and find the difference between them (the wet thermometer should be cooler because of water evaporation). Copy this chart on the chalkboard and help students find the relative humidity following these steps.

Difference Between Wet and Dry Bulb Temperature

Dry Bulb Temp	0	1	2	3	4	5	6	7	8	9	10
16°C	100	90	81	71	63	54	46	38	30	23	17
17°C	100	90	81	72	64	55	47	40	32	25	18
18°C	100	91	82	73	65	57	49	41	34	27	20
19°C	100	91	82	74	65	58	50	43	36	29	22
20°C	100	91	83	74	66	59	51	44	37	31	24
21°C	100	91	83	74	67	60	53	46	39	32	26
22°C	100	92	83	76	68	61	54	47	40	34	28
23°C	100	92	84	76	69	62	55	48	42	36	30
24°C	100	92	84	77	69	62	56	49	43	37	31
25°C	100	92	84	77	70	63	57	50	44	39	33

- Find the dry bulb temperature in the left column.
- Find the difference in the top row.
- Find the intersection of the row and column.

For example: Dry bulb temperature is 20°C.
Wet bulb temperature is 17°C.
Difference is 20°C − 17°C = 3°C.
Relative humidity is 74%.

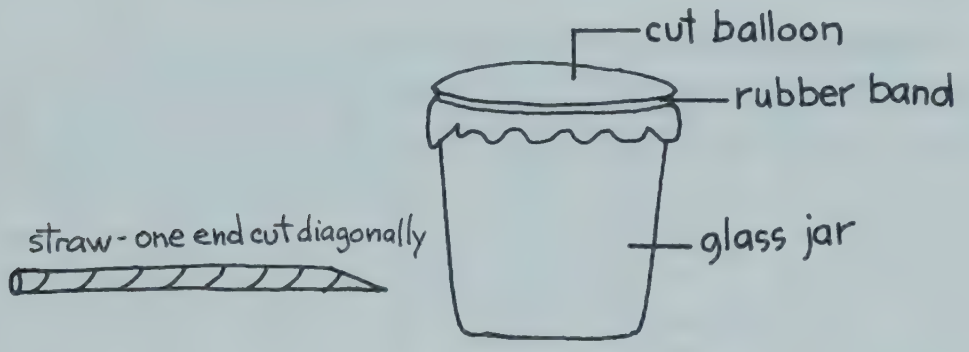
Making a Barometer—Under Pressure!

Concept: A barometer shows rising and falling air pressure and indicates changes in weather.

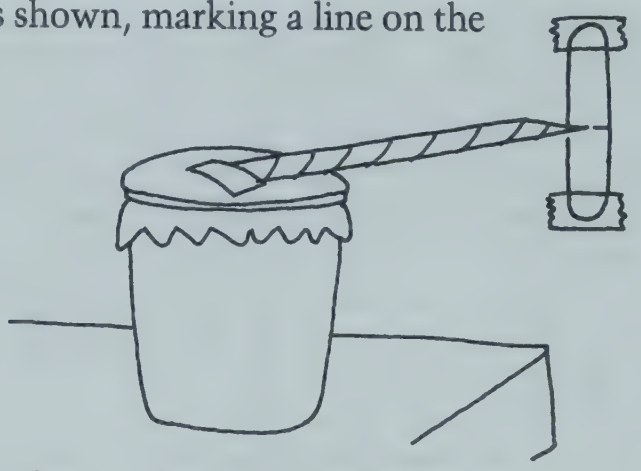
Materials: *For each group:* glass jar, balloon, rubber band, plastic straw, tongue depressor or ice-cream stick, scissors, tape, activity sheet (page 75).

Plan: Explain to students that a barometer measures changes in air pressure and that changes in air pressure indicate changes in weather. For example, a falling barometer reading shows decreasing air pressure and indicates approaching stormy weather; a rising barometer reading shows increasing air pressure and indicates clearing weather. Students will make a simple barometer and use it to predict weather conditions.

Have students cut a balloon lengthwise, stretch it over the mouth of the jar, and secure it with a rubber band. Next have students cut one end of the straw diagonally.



Have students tape the uncut end of the straw to the center of the balloon. Tell them to tape the tongue depressor on the wall and then to position the jar and pointer as shown, marking a line on the depressor even with the pointer.



Have each group designate a member to check the barometer at about the same time each day and to record his or her observations on the activity sheet. Have another group member predict the next day's weather based on the reading and a third group member check the prediction made on the previous day.

Name _____ Date _____

Weather or Not

Day	Barometer Reading Up?	Barometer Reading Down?	Weather Prediction	Check if Prediction Is Correct
1				
2				
3				
4				
5				
6				
7				

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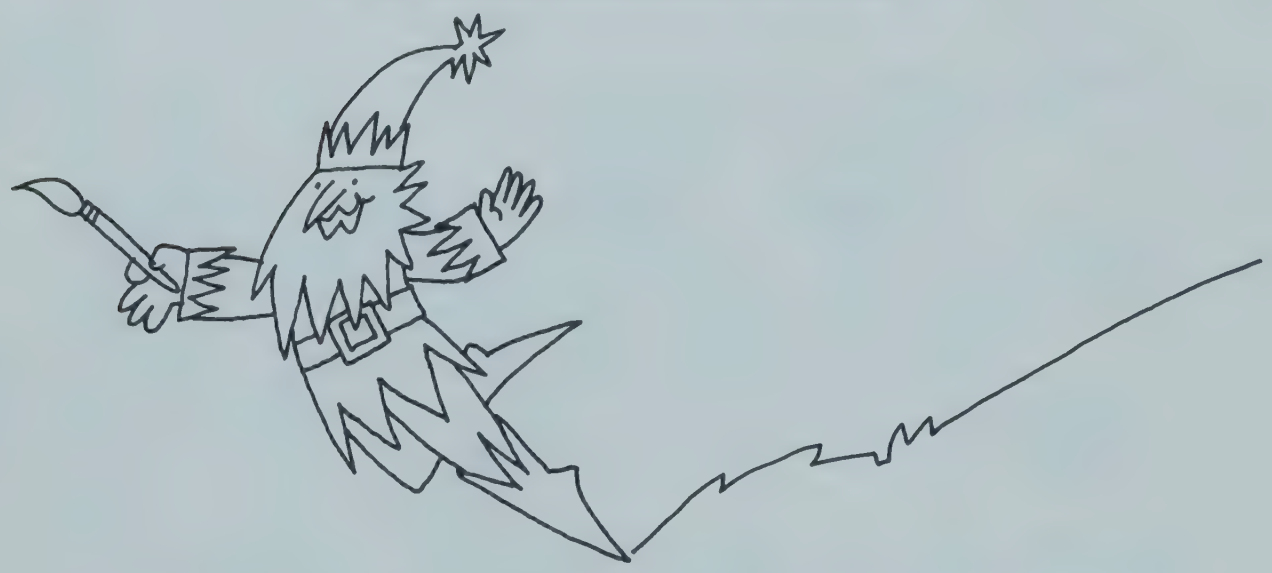
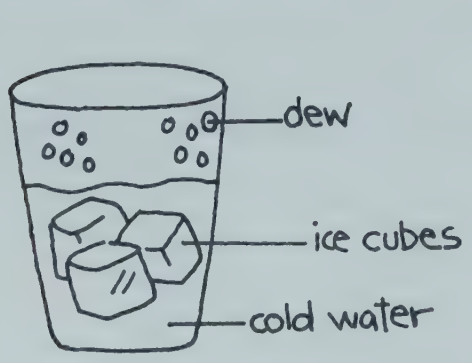
Do Point out the Dew Point —I'm in a Fog

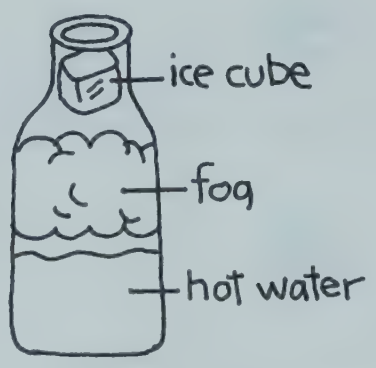


Concept: Dew forms when objects such as grass on the earth's surface become colder than the surrounding air. When air reaches its dew point, its relative humidity is 100%. Fog is also the result of lowering the temperature of air below its dew point.

Materials: *For each group:* glass; water; ice cubes; hot water; narrow, transparent glass bottle, such as a milk bottle.

Plan: Tell students that they will chill to its dew point the air touching the glass. Have them add ice cubes to a glass of water and observe the condensation forming on the outside of the glass. Explain that both fog and clouds can result as air is cooled below its dew point and condenses on dust in the air. Near the earth's surface the condensation is called fog. High above the surface it is called a cloud. To form fog, have students place some hot water in a clear, narrow glass container, such as a milk bottle, and put an ice cube in the mouth of the bottle.





Additional Activity: Have students draw a picture of or write a poem about a foggy day, frost on a meadow, or a spring dew. Some students may prefer to collect pictures or poems about fog and dew.

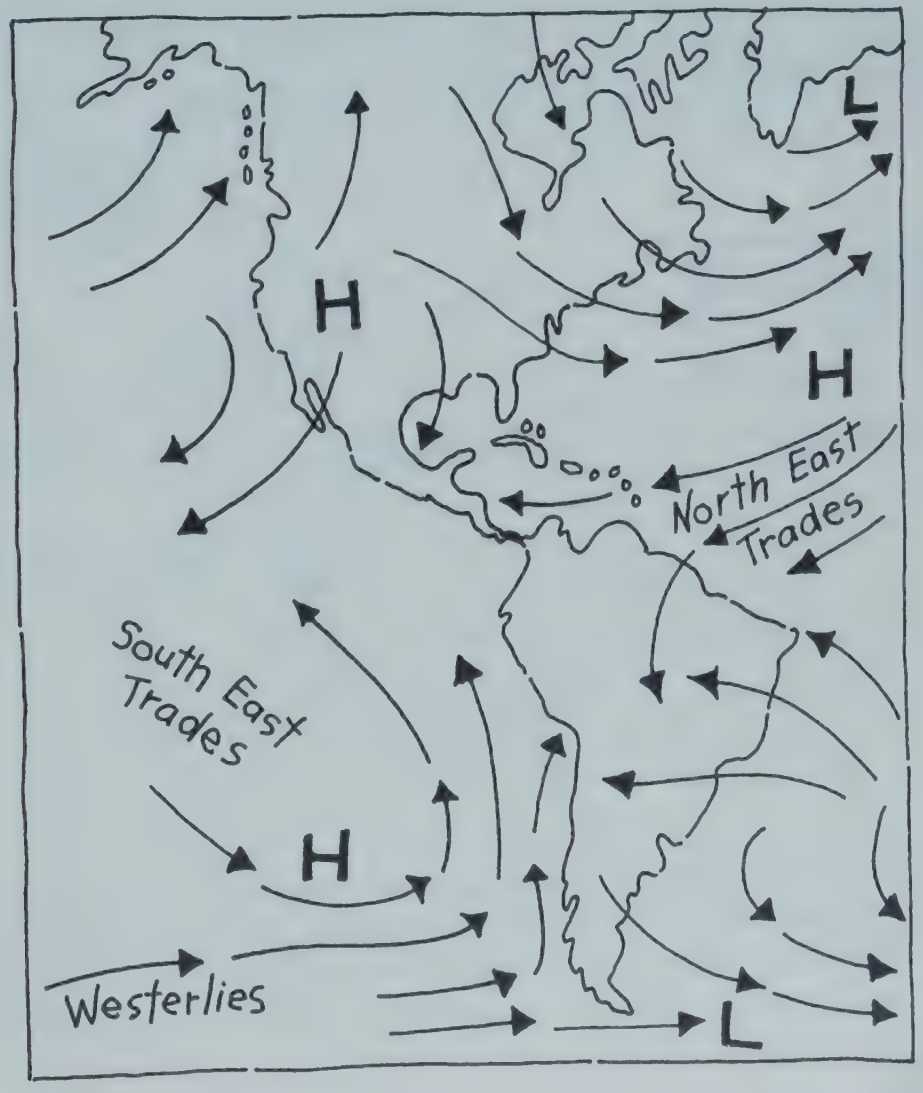
All's Quiet on the Western Front

Concept: When an air mass remains over a region of the earth, the air mass takes on the weather properties of the region. The air mass may become cold and dry, cool and moist, warm and moist, or hot and dry. Different kinds of air masses have different densities and do not mix easily. Instead they form boundaries called fronts.

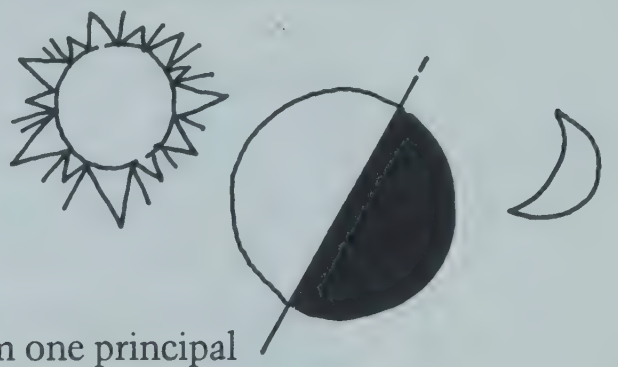
Materials: Newspaper weather sections or television weather reports.

Plan: Tell students they will use weather maps in newspapers or follow television weather reports to identify a front and follow its progress for several days. They should note the weather conditions in the areas their fronts are leaving and entering, and keep track of changes.

Additional Activity: Have groups of students report on cyclones, tornadoes, thunderstorms, and hurricanes, indicating their sources, wind speeds, and resulting damages. Students may wish to include information on the history of some especially destructive storms, as well as on precautions that people might take to minimize loss of life and property.



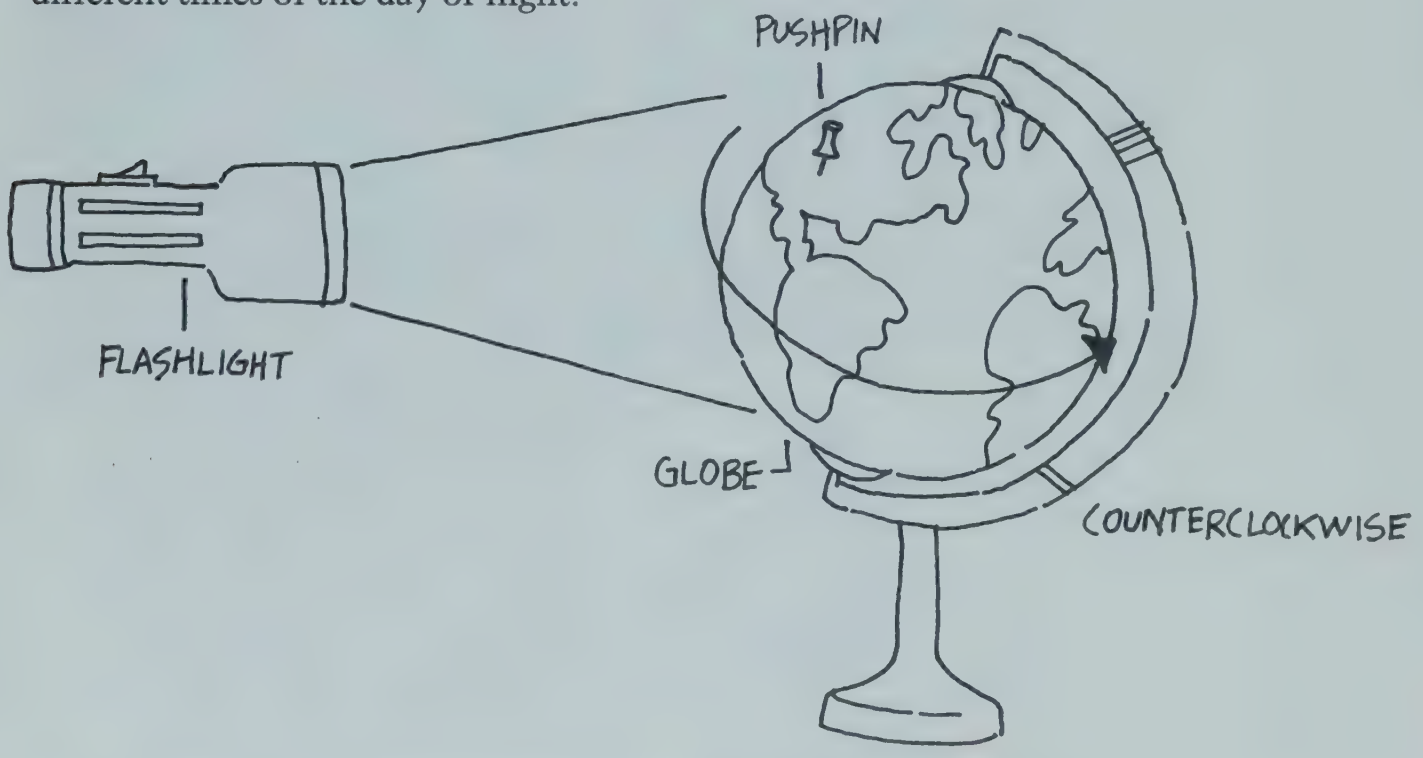
As Different as Night and Day



Concept: Since the earth receives its light from one principal source, the sun, and since the earth rotates on its axis from west to east, day and night alternate.

Materials: *For each group:* flashlight, globe, pushpins of different colors or removable tape.

Plan: To show the course of day and night, have students use a globe to locate where they live. Have them put a pushpin or removable tape on the spot. Next, have the group pull down the shades on the classroom windows or go into a darkened room. One group member should hold the flashlight and direct it to the push pin or tape. Another group member should slowly turn the globe counterclockwise (west to east) to simulate the earth's rotation. Remind students that one full rotation takes twenty-four hours. To emphasize this, have students point out what they might be doing at different times of the day or night.



Additional Activity: Have students choose a city or country far from home and use a pushpin of another color to see relative day- and nighttimes. Some students may wish to use several pushpins and choose places from Santa Fe to Singapore. Have students identify "opposite" cities.

Going Around in the Best Circles

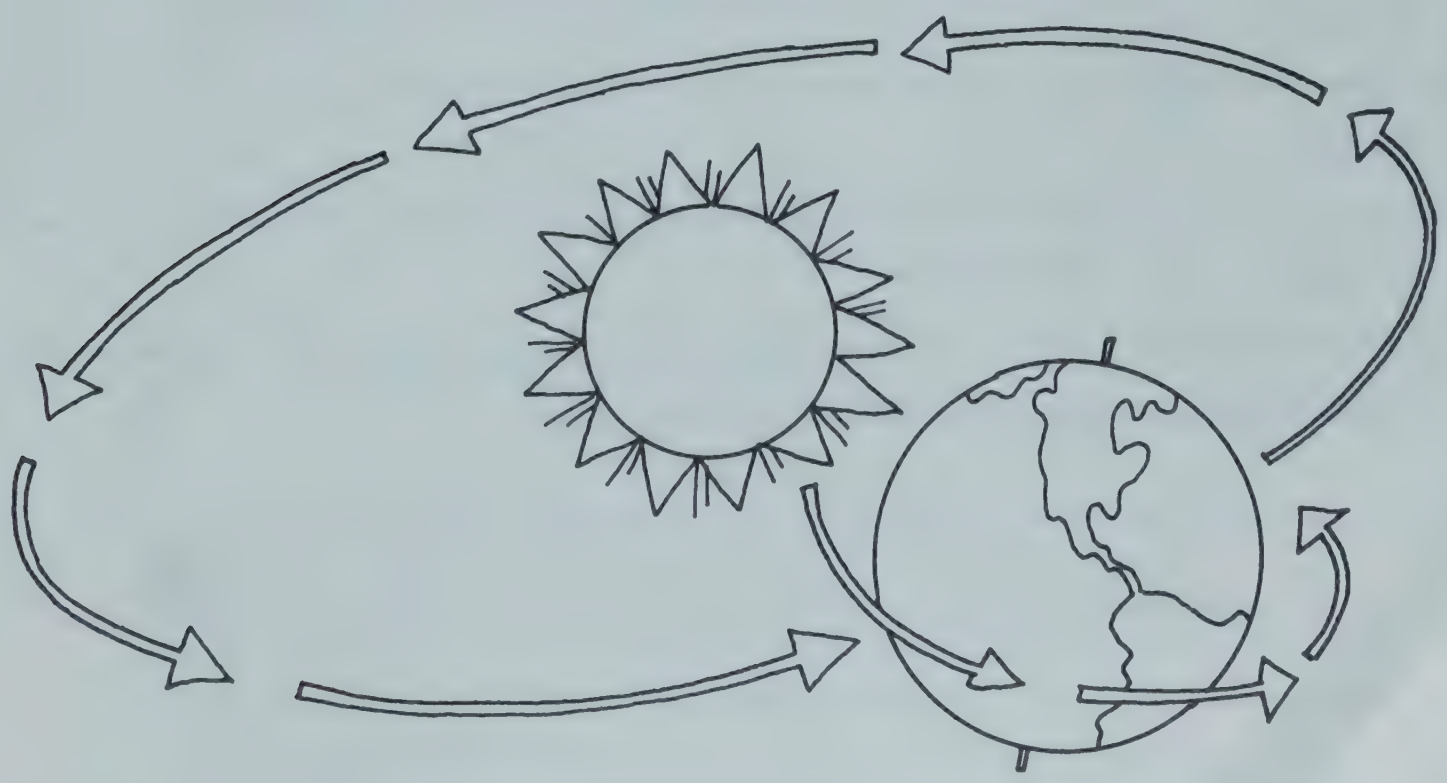
Concept: The Earth rotates on its axis as it revolves around the sun. Rotation determines days, and revolution determines years.

Materials: Students themselves, gym mats or soft ground, rope.

Plan: Students can use their bodies to demonstrate both the rotation of the Earth and its revolution around the sun. Tell students that the Earth revolves around the sun in an almost elliptical orbit and that the journey takes 365 1/4 days, or one year, and is about 66,000 miles (100,000 km) long. Have students use rope to make a large and slightly elliptical path on the mat or ground.

Then have students move around the path slowly in a counterclockwise direction. As they move in orbit, have students begin rotating counterclockwise to simulate the Earth's rotation on its axis. Caution students to avoid becoming dizzy. As students gain confidence you may wish to extend this activity by allowing them to simulate the rotations and revolutions of other planets. Several groups could model the solar system, keeping in mind that Pluto is forty times farther from the sun than the Earth is.

Additional Activity: Have students make a chart that shows the length of each planet's year (the time it takes each planet to revolve once around the sun) as it relates to an Earth year. Also include in the chart the length of each planet's day (the time it takes each planet to rotate on its axis). Note that both Venus and Uranus rotate clockwise.



Name _____ Date _____

A Shadow of Myself

A shadow is made when light cannot pass through an opaque, or non-see-through, object. There is a relationship between the height of the sun and the length of a shadow. Work with a partner and a meter ruler to discover this relationship. To do this, measure your shadow in the same spot at several different times on a sunny day.

TIME	LENGTH OF SHADOW	POSITION OF SUN
9 A.M.		
10 A.M.		
11 A.M.		
12 NOON		
1 P.M.		
2 P.M.		
3 P.M.		
4 P.M.		

Relationship of shadow length to sun position:

_____

_____

_____

_____

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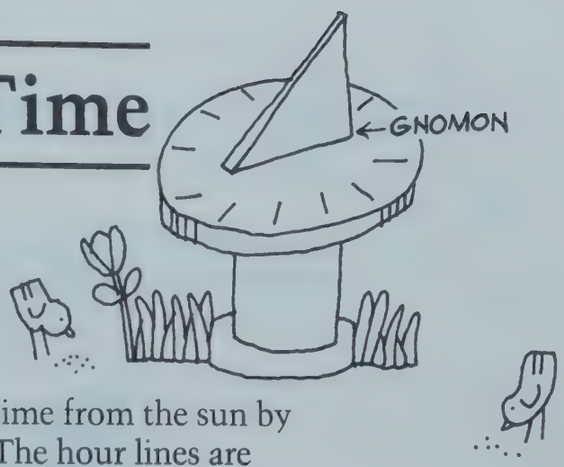
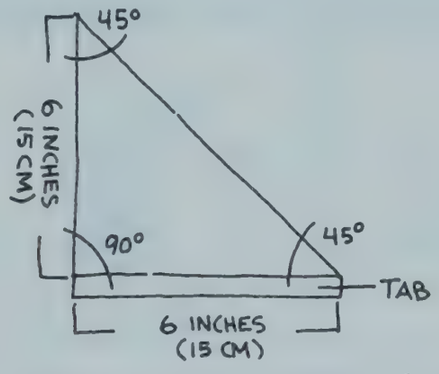
Shadows of Time



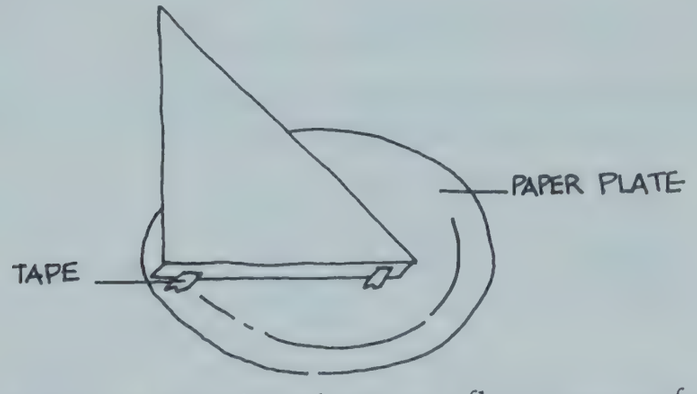
Concept: The garden-variety sundial tells time from the sun by measuring its hour angle from the meridian. The hour lines are inscribed on a dial plate; the gnomon casts the shadow, whose edge points to the time.

Materials: *For each group:* paper plate about 12 inches (30 cm) in diameter, protractor, ruler, pencils, oaktag, tape, scissors.

Plan: Tell students that they will make a sundial to see how people told time long ago. First have students use their protractors, rulers, pencils, and oaktag sheets to make the right-triangular gnomon using a pattern like the one that follows.



Have them position and tape the gnomon on the paper plate as shown below.

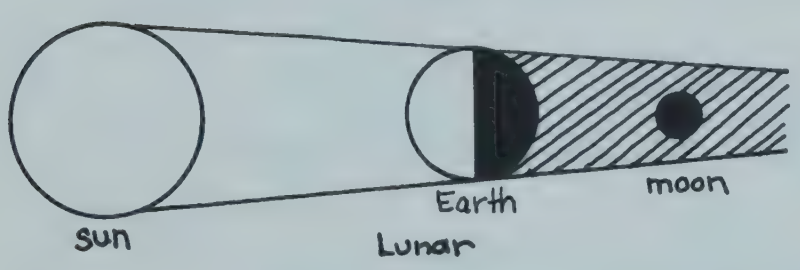


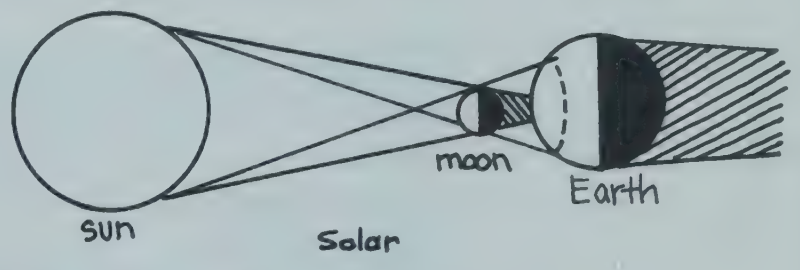
The sundial should be placed outdoors on a flat, sunny surface. The top of the triangle should face south. Have students start drawing shadow lines early in the day and label each by the hour. You may want students to draw the lines every hour or two. When students are finished they will have made a simple sundial.

Additional Activity: Have students explore the way more complex sundials work, using angles of latitude.

Using Your Head to Show an Eclipse

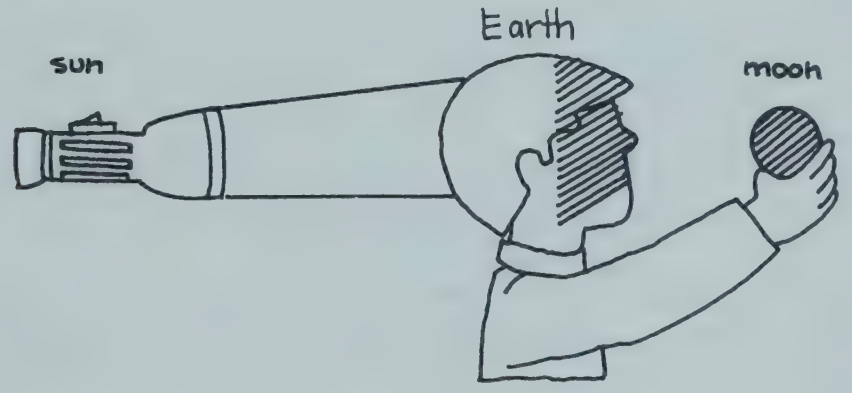
Concept: Solar and lunar eclipses occur when the sun, Earth, and moon are in a straight line.





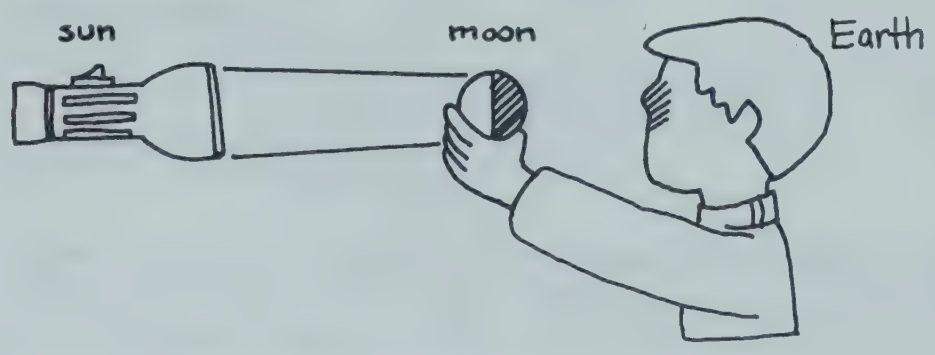
Materials: *For each group:* flashlight, ball, student volunteer.

Plan: Tell students that both solar and lunar eclipses are caused by the positions of the sun, Earth, and moon relative to one another. To demonstrate a lunar eclipse, have one group member hold a flashlight several feet (a meter) behind another member's head. The second student should be facing away and holding the ball at the head level.



The Earth's shadow causes the lunar eclipse.

To demonstrate a solar eclipse, have a student shine a flashlight toward a student who is holding the ball in front.



The moon's shadow falls on the Earth and blocks the sun.

Additional Activity: Have students research recent lunar and solar eclipses and find out when the next eclipse of both types will be observable in their area.

A Model System

Concept: The distances from the sun to the planets vary from about 36 million miles (58 million km) for Mercury to about 100 times as far for Pluto. The diameter of each planet varies: Jupiter, the largest planet, has a diameter about 55 times that of Pluto's, the smallest planet.

Materials: *For the class:* large sheets of newsprint, tape, metric tape.

Plan: Students can make a model of the solar system showing distances from the sun and relative diameters for each planet. Copy this chart on the chalkboard.

Planet	Relative Diameter	Approximate Distance from Sun (millions of mi)	(millions of km)
Mercury	2	36	58
Venus	5	67	108
Earth	5	93	150
Mars	2.5	140	225
Jupiter	55	480	770
Saturn	45	890	1,430
Uranus	20	1,800	2,900
Neptune	20	2,800	4,500
Pluto	1	3,700	6,000

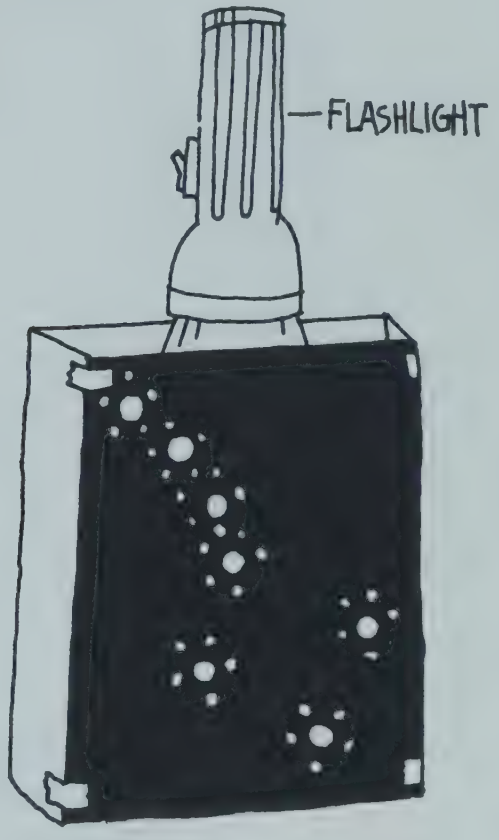
Have students work in groups to model each planet so that Jupiter has a diameter about 55 times larger than that of Pluto. If they decide to use a diameter of 1/2 inch (1 cm) for Pluto, Jupiter will have a diameter of 27 1/2 inches (55 cm). Have students form groups of ten (the nine planets and the sun) and go outside to a playground, parking lot, or field. Have them decide on a scale, measure, and make a living model of planetary distances from the sun.

Seeing Stars

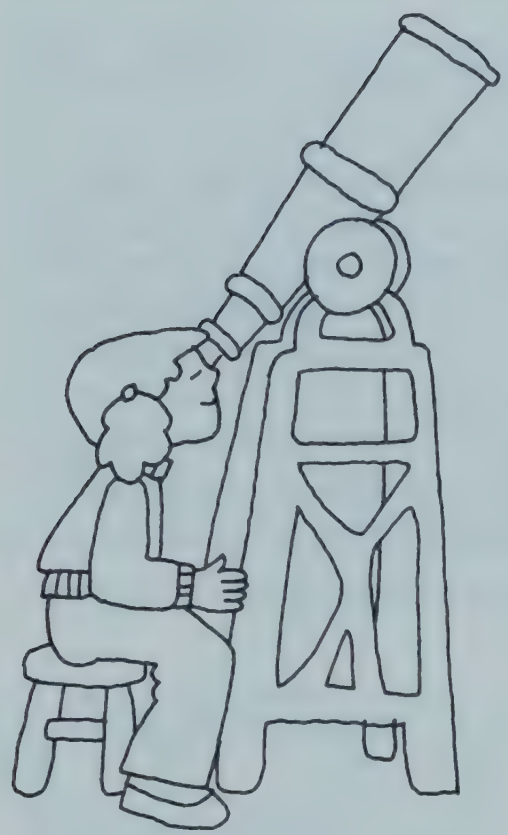
Concept: Many stars can be seen in the night sky. Traditionally, the stars are grouped into constellations that honor or resemble deities or figures in mythological tales. More modern patterns have been observed.

Materials: *For each student:* rectangular cereal boxes, black or navy construction paper, white pen or pencil, maps of constellations or student-drawn observations, geometric compass, flashlight.

Plan: Explain to students that they can model constellations, or star patterns of their own choosing, from the night sky. First have students draw their pattern in white on the dark construction paper. Next they should tape the dark paper to the cereal box and, using the geometric compass, carefully punch holes through the box at their "star" points. When students insert their flashlights into the top or bottom of the cereal box and turn them on, they will have a model of a constellation from the night sky.



News from Near and Far



Concept: Optical telescopes reflect or refract. A reflecting telescope uses mirrors to gather light and magnify a view. A refracting telescope uses a lens to gather and focus light.

Materials: *For each group:* clear plastic wrap, scissors, water, dropper, newspaper.

Plan: Tell students that they will simulate a refracting telescope. Have students cut out a 5 inch x 5 inch (12 cm x 12 cm) square of plastic wrap and use the dropper to put a drop of water in the middle of their square. Next tell students to hold their square about 5 inches (12 cm) above a page of newspaper and to observe the size of the print as they move their "plastic wrap telescope" up and down. Explain that the "telescope" is simulating a convex lens that enlarges objects from a distance.

Additional Activity: Have students research famous telescopes, such as the Hale and the Yerkes, and identify them as refracting or reflecting.

Some Bones About It

Concept: Bones and muscles provide support for and allow movement in the human body. Proper foods and exercise help keep bones and muscles healthy. Calcium is a mineral necessary for healthy bones.

Materials: *For each group:* two clean chicken bones, two glass jars with covers, water, vinegar, towel.

Plan: After explaining to students that vinegar is an acid that removes calcium from bones, tell them that they will see the results of removing calcium from bones. First have students examine the chicken bones, noting their hardness and lack of flexibility. Then have students place a bone in each jar, fill one jar with water and the other with vinegar, and cover the jars tightly. After one week, have students remove the bones from each jar, wash and dry the bones, and observe their hardness and flexibility. Students should discover that when calcium is removed, a bone becomes soft and flexible.

Additional Activity: Have students list foods containing calcium.

Muscling In

Concept: Exercise promotes healthy bones and muscles. However, overdoing exercise can lead to injury or muscle fatigue.

Materials: Watch or timer with second hand.

Plan: Explain to students that they will be exercising the muscles in their hands until the muscles overtire. Have students open and close their fists as many times as possible in one minute and record the number of closings. Then have them repeat the activity in four additional one-minute trials, recording the number of closings each time. Students may wish to use a chart such as the one below to record their findings.

Trial	# of Fist Closings
1.	
2.	
3.	
4.	
5.	

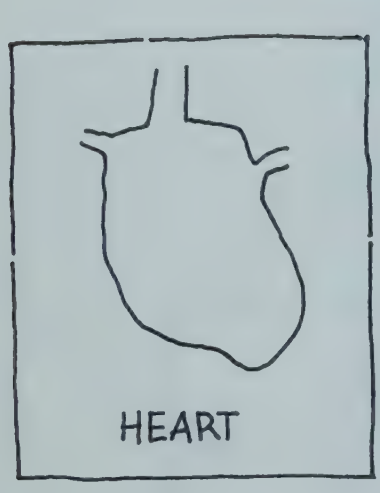
Have students look at their results and also describe how their hands felt.

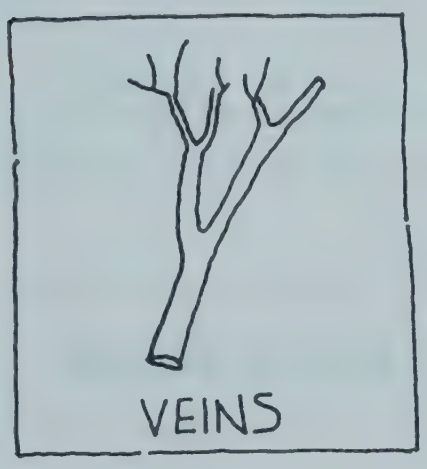
Additional Activity: To show wear and tear on other muscles, have students time how long they can hold their arms straight out to the side. Have them decide if holding a textbook in each hand increases muscle fatigue.

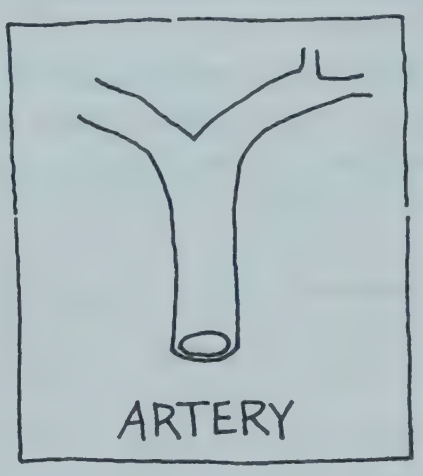
"You've Gotta Have Heart"—and Lungs

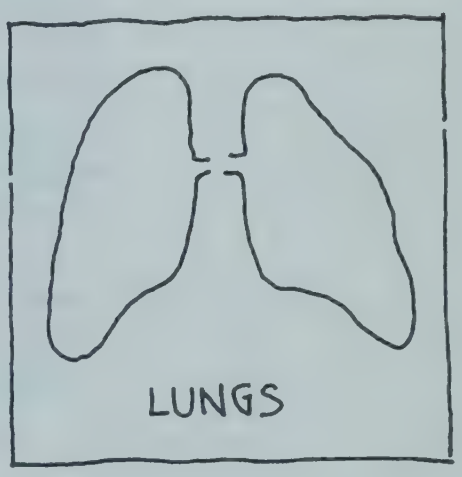
Concept: The circulatory and respiratory systems are two-way systems that move blood and oxygen throughout the body.

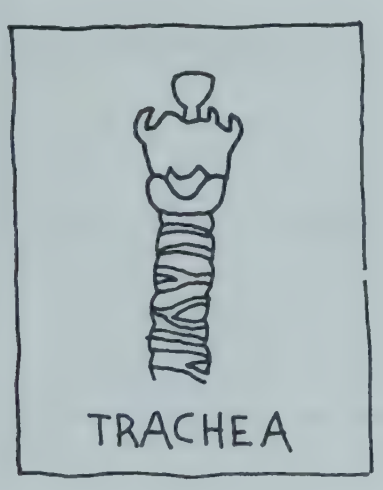
Materials: *For each group:* a copy of the following diagrams.

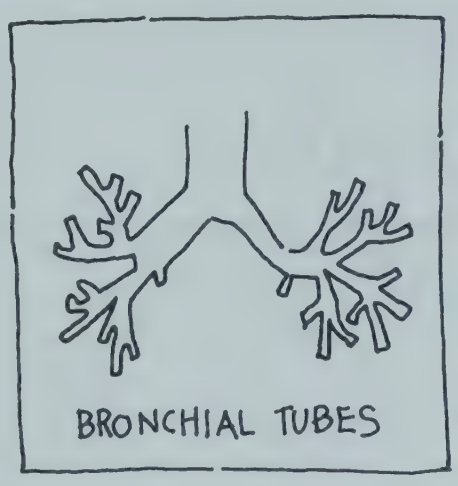


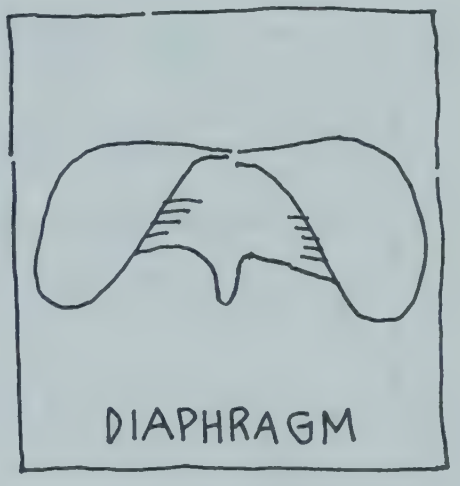








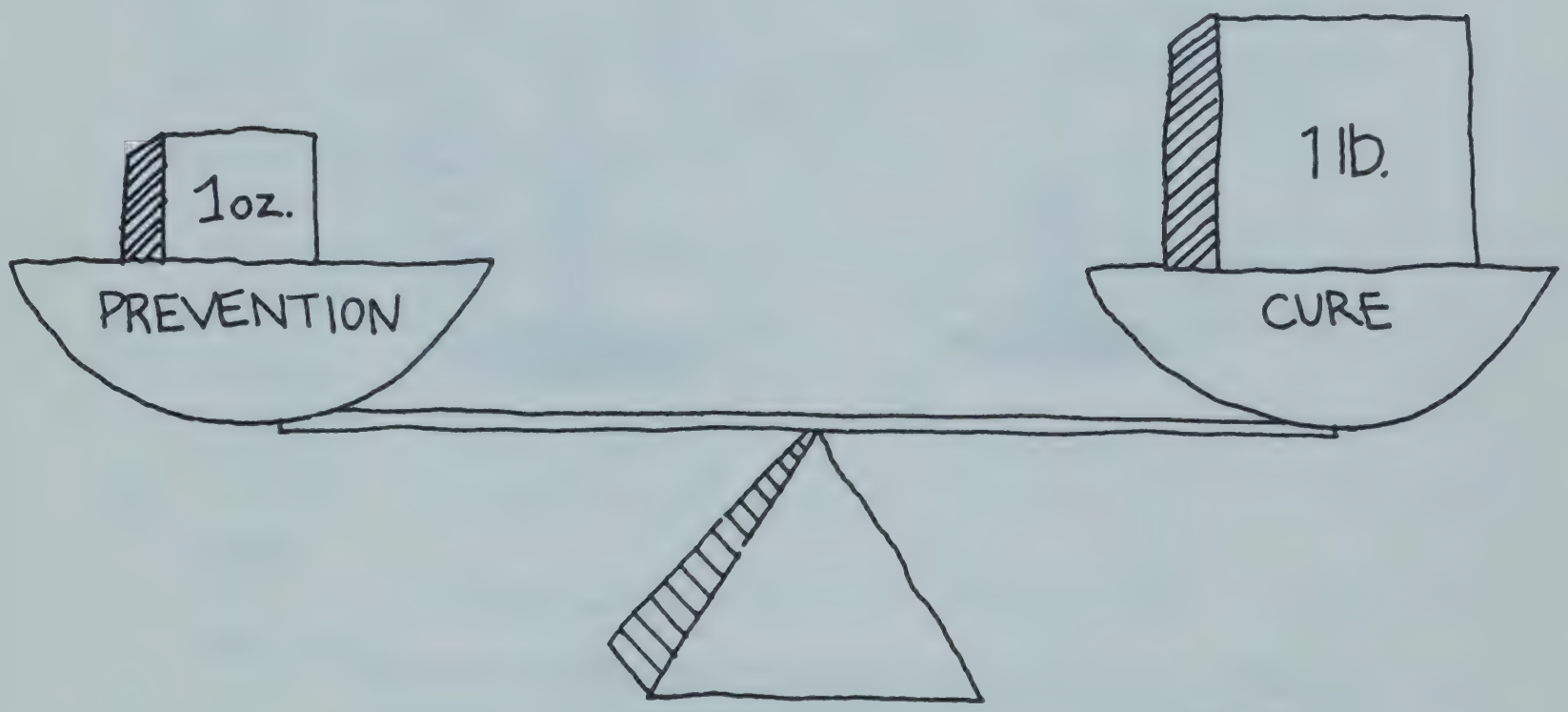




Plan: Tell students that the diagrams show important parts of the respiratory and circulatory systems. Have students work together to find the roles of each part and to plan a presentation that shows how either oxygen travels through the respiratory system or blood travels through the circulatory system. Have groups present their system.

Additional Activity: Have students write a brief essay or poem on the journey of a breath of air or a drop of blood through the human system. Encourage humorous comments.

An Ounce of Prevention



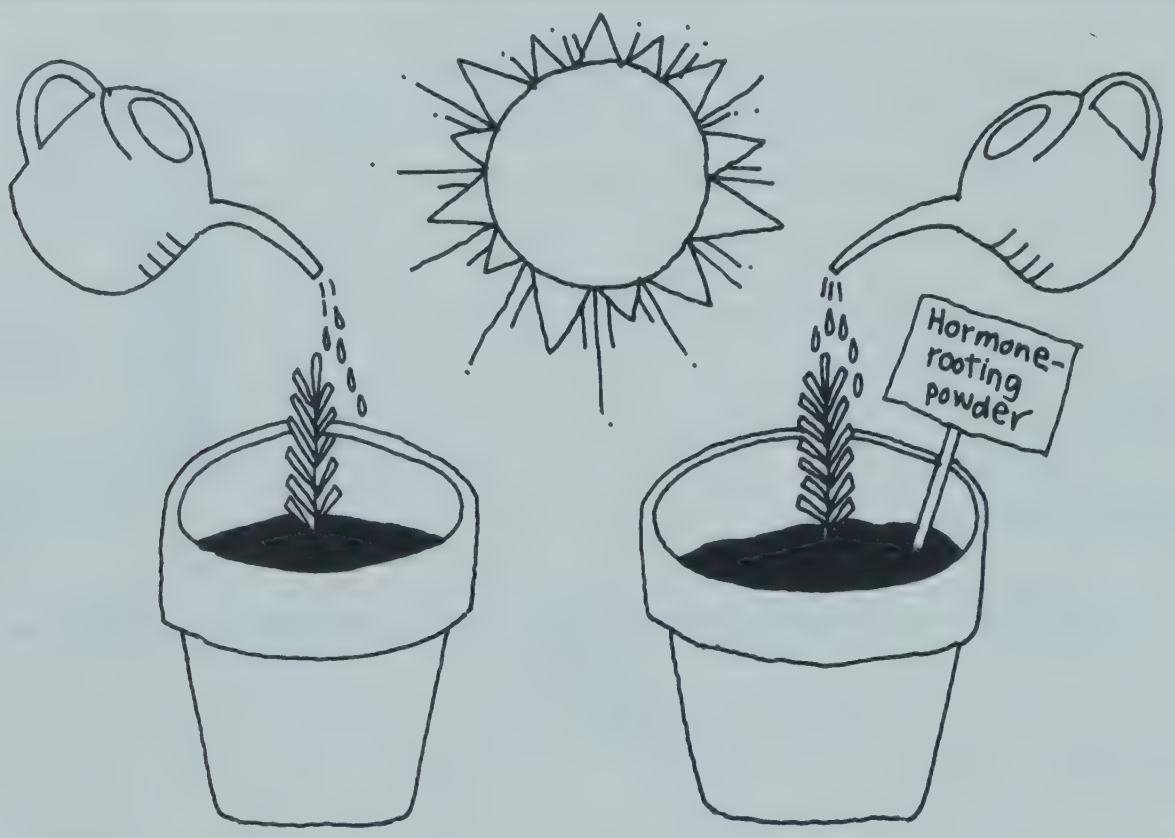
Concept: Many diseases can be prevented by healthy habits.

Materials: Three plastic cups, water, red food coloring, spray bottle, straw, white cotton rag or towel.

Plan: Explain to students that they will use red food coloring to represent disease-spreading microbes. Have students fill each cup with clear water. Then have them fill the spray bottle with water and several drops of red food coloring. To simulate a sneeze, have students spray one cup of clear water with colored water and observe what happens. Then have students "share a straw" by inserting the straw in the spray bottle of colored water and then in one cup of the clear water and observing what happens. Finally, to simulate sharing towels, students should dip the rag in the spray bottle and then in the last cup of clear water and observe the change. Ask students to speculate on the ways colds spread. Remind students that many diseases are *not* contagious and that many diseases are *not* spread by means such as the ones they have demonstrated.

Additional Activity: Have students research and report on how people get diseases such as malaria, polio, tetanus, rabies, cancer, heart disease, and diabetes. Have students suggest precautions that may help prevent these diseases or lessen their impact.

You Have a Lot of Nerves—and Glands



Concept: The nervous and endocrine systems of the human body are considered control systems. The brain and nerves can signal the glands (organs that make chemicals) to release hormones (chemicals). Some hormones control growth.

Materials: Two small clay pots, two small sprigs of rosemary, potting soil, hormone-rooting powder. (You may get hormone-rooting powder at a garden supply store.)

Plan: Tell students that they will be able to see the results of using hormone powder on plants. Demonstrate for students by filling each pot about three-quarters full of potting soil. Then dip one sprig of rosemary in the rooting hormone. Because rooting powder is poisonous, be sure students do not come into contact with it as they observe the procedure. Next, insert the stem of each sprig of rosemary about 1 inch (2 ½ cm) into the potting soil. Place the clean pots in sunlight. Tell students to supply the plants with water for two to three weeks. After that period of time, pull both sprigs from the soil and have students observe and compare their growth. Have students speculate on what rooting hormone does for plants.

Additional Activity: Explain to students that, although plants do not have glands or nerves like humans, they can be used as a model of how some hormones affect growth. Have students research hormones that are used by the body to control growth. Have them make a chart of the hormones, the glands that secrete them, and their role in human growth.

Name _____ Date _____

Drugs: Use or Abuse?

Drugs can cause changes in the nervous and endocrine systems of the body. These changes can be physical, mental, emotional, or behavioral. Some of the changes are good and some are bad. Some uses are legal and some are illegal.

Copy and complete this chart.

Drug	Use/Abuse
1. Alcohol	
2. Penicillin	
3. Aspirin	
4. Marijuana	
5. AZT	

List some drugs you know about. Do people mostly use or mostly abuse them?

Drug	Use/Abuse
6.	
7.	
8.	
9.	
10.	
11.	
12.	

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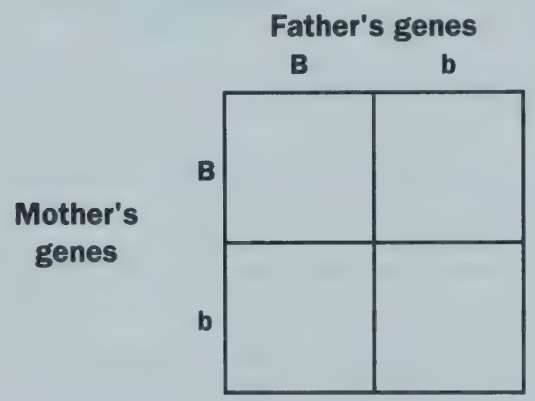
Do You Have Blue Genes?

Concept: Scientists use a chart called the Punnett square to predict traits of offspring. The trait that results from the gene with the most influence is called the dominant trait; the trait from the gene with the least influence is called the recessive trait.

Materials: Paper, brown and blue pencils.

Plan: Explain to students that brown eyes are dominant and blue eyes are recessive. If each parent has a gene for brown eyes and a gene for blue eyes, there is a 75 percent chance that their offspring will have brown eyes. To show this graphically, draw the following Punnett square on the chalkboard.



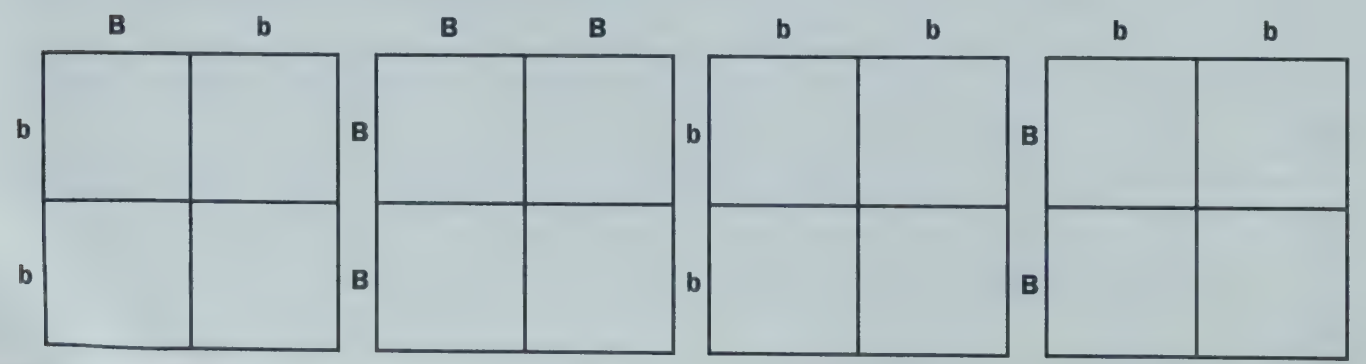
B—dominant brown
b—recessive blue

Have students copy the square using blue pencil for b and brown for B. Have them fill in the possible combinations in each box.

	B	b
B	BB	Bb
b	Bb	bb

Only bb will give blue eyes, since brown dominates blue. bb is 1/4 or 25 percent of the square.

Then have students predict the percent of blue eyes for the following combinations of parent genes.



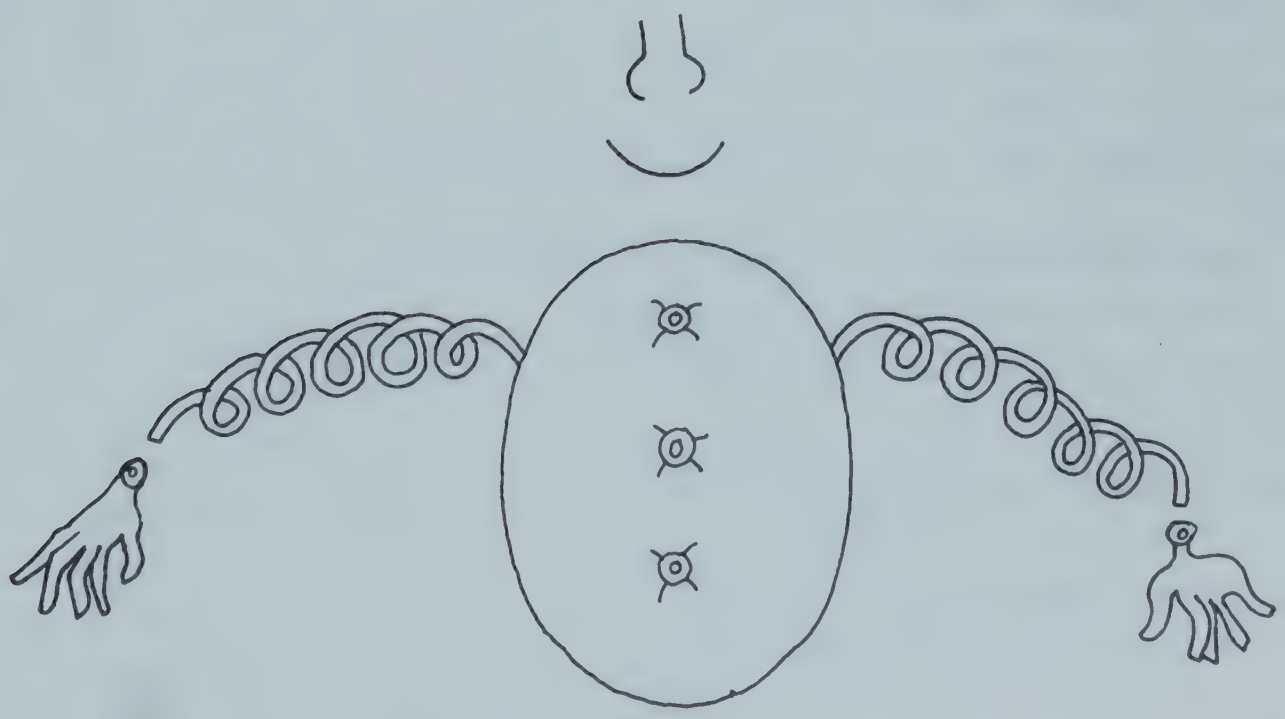
Answers: 50% blue; 0% blue; 100% blue; 0% blue

Name _____ Date _____

Make a Mild Child Monster

The table shows some of the dominant and recessive traits of Ma and Pa Monster. Use your knowledge of dominant and recessive traits to complete the drawing of the child monster.

Body Part	Dominant	Recessive	Ma	Pa
Head	Square (H)	Heart shaped (h)	h	H
Antennae	2 Straight (A)	3 Spiral (a)	a	a
Eyes	3 Round (E)	4 Triangle (e)	E	e
Legs	Long, skinny (L)	Short, fat (l)	L	l
Feet	Large, furry (F)	Small, pointed (f)	F	F



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Printed in USA